ParkerVision®

Wireless to the MAX™

WR1500

4-Port Wireless DSL/Cable Router

USER'S GUIDE

WWW.PARKERVISION.COM

D2D TECHNOLOGY

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Designed and manufactured in the USA.

FCC INTERFERENCE STATEMENT

FCC ID: JFE-D2D00003

This device complies with Part 15 of the FCC rules. Operation is subject to the following two conditions:

This device may not cause harmful interference.

This device must accept any interference received, including interference that may cause undesired operations.

This equipment has been tested and found to comply with the limits for a Class B digital device pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy, and if not used in accordance with the instructions, may cause harmful interference to radio communications.

If this equipment does cause harmful interference to radio/television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the nterference by one of more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and the receiver.

Connect the equipment to an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

INFORMATION TO USER: THE USER'S MANUAL OR INSTRUCTION MANUAL FOR AN INTENTIONAL OR UNINTENTIONAL RADIATOR SHALL CAUTION THE USER THAT CHANGES OR MODIFICATIONS NOT EXPRESSLY APPROVED BY THE PARTY RESPONSIBLE FOR COMPLIANCE COULD VOID THE USER'S AUTHORITY TO OPERATE THE EQUIPMENT.

"FCC RF exposure requirements: When in operation, the device should be located such that it is more than 20 cm. away from people and their person. This transmitter is restricted for use with the specific antenna(s) tested in the application for Certification. The antenna(s) used for this transmitter must not be co-located or operating in conjunction with any other antenna or transmitter."

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ParkerVision®

INTRODUCTION

All ParkerVision products are designed and manufactured by ParkerVision. Products are fully compliant with IEEE 802.11b standards and are optimized to provide maximum possible speed and bandwidth through your Internet connection for fastest uploads and downloads.

The distance capabilities of your wireless network equipment directly affect your signal quality. Distance capabilities are usually stated in terms of outdoor, open field reach. However, this reach is greatly diminished indoors by walls, doors, construction techniques and appliances that may block the radio signal. A wireless network adapter that tests outdoors at 200 feet could, in an indoor environment, provide 20 feet in one direction and as little as 5 or 10 feet in another direction. Factors such as building materials, floor plans and furnishings can greatly impact the signal range, quality and rate of data transmission. The extent to which your signal is affected varies greatly depending on your environment.

Wireless network products powered by D2D technology will provide better performance than other products because they can achieve open field distances of up to one mile, (when a D2D enabled adapter is used in conjunction with a D2D enabled base station). The D2D adapter alone provides 3 to 7 times the distance of other leading brands. This is sufficient to reach all rooms in most homes or small offices.

D2D TECHNOLOGY

Part I

Getting Started

The following chapters are structured as a step-by-step guide to help you connect, install and setup your ParkerVision WR1500 Wireless Router.

Chapter 1:
Getting to Know Your ParkerVision WR1500 Wireless Router

This chapter introduces the main features of the ParkerVision WR1500 Wireless Router.

1.1 Introduction

The ParkerVision WR1500 Wireless Router provides wireless connectivity. As an Internet gateway, your WR1500 Wireless Router can share an Internet connection (through a cable or xDSL modem) with multiple computers using SUA/NAT and DHCP. The WR1500 Wireless Router offers highly secured wireless connectivity to your wired network with IEEE 802. lx, WEP data encryption and MAC address filtering.

The WR1500 Wireless Router is easy to install and configure. The embedded web-based configurator and SNMP network management enables remote configuration and management of your WR1500 Wireless Router.

1.2 Features of the ParkerVision PC WR1500 Wireless Router

The following are the essential features of the ParkerVision WR1500 Wireless Router .

4-Port Switch

A combination of switch and router makes your WR1500 Wireless Router a cost-effective and viable network solution. You can connect up to four computers to the LAN ports on your WR150 Wireless Router without the cost of a hub.

10/100M Auto-negotiating Ethernet/Fast Ethernet Interface

This auto-negotiating feature allows the WR1500 Wireless Router to detect the speed of incoming transmissions and adjust appropriately without manual intervention. It allows data transfer of either 10 Mbps or 100 Mbps in either half-duplex or full-duplex mode depending on your Ethernet network.10/100M Auto-crossover Ethernet/Fast Ethernet Interface.

The LAN interface automatically adjusts to either a crossover or straight-through Ethernet cable. 10/100 Mbps Ethernet WAN.

The 10/100 Mbps Ethernet WAN port attaches to the Internet via broadband modem or router.

Reset Button

The WR1500 Wireless Router reset button is built into the rear panel. Use this button to restore the factory default password to 1234; IP address to 192.168.1.1, subnet mask to 255.255.255.0 and DHCP sever enabled with a pool of 8 IP addresses starting at 192.168.1.33.

Brute-Force Password Guessing Protection

The WR1500 Wireless Router has a special protection mechanism to discourage brute-force password guessing attacks on the WR1500 Wireless Router's management interfaces. You can specify a wait-time that must expire before entering a fourth password after three incorrect passwords have been entered. Please see the appendix for details about this feature.

WR1500 Wireless Router LED

The blue WR1500 Wireless Router LED (also known as the Breathing LED) is on when the WR1500 Wireless Router is on and blinks (or breaths) when data is being transmitted to/from its wireless stations. You may use the web configurator to turn this LED off even when the WR1500 Wireless Router is on and data is being transmitted/received.

802.11b Wireless LAN Standard

WR1500 Wireless Router products containing the letter “B” in the model name, such as WR1500 Wireless Router B-2000, WR1500 Wireless Router B-2000 v.2, comply with the 802.1 lb wireless standard.

The 802.1 lb data rate and corresponding modulation techniques are as follows. The modulation technique defines how bits are encoded onto radio waves.

Output Power Management

Power Management is the ability to set the level of output power.

There may be interference or difficulty with channel assignment when there is a high density of APs within a coverage area. In this case you can lower the output power of each Wireless Router, thus enabling you to place Wireless Routers closer together.

Limit the number of Client Connections

You may set a maximum number of wireless stations that may connect to the WR1500 Wireless Router. This may be necessary if for example, there is difficulty with channel assignment due to a high density of APs within a coverage area.

SSL Passthrough

SSL (Secure Sockets Layer) uses a public key to encrypt data that’s transmitted over an SSL connection. Both Netscape Navigator and Internet Explorer support SSL, and many web sites use the protocol to obtain confidential user information, such as credit card numbers. By convention, URLs that require an SSL connection start with “https” instead of “http”. The WR1500 Wireless Router allows SSL connections to take place through the WR1500 Wireless Router.

Firewall

The WR1500 Wireless Router employs a stateful inspection firewall with DoS (Denial of Service) protection. By default, when the firewall is activated, all incoming traffic from the WAN to the LAN is blocked unless it is initiated from the LAN. The WR1500 Wireless Router firewall supports TCP/UDP inspection, DoS detection and prevention, real time alerts, reports and logs.

IEEE 802.1 x Network Security

The WR1500 Wireless Router supports the IEEE 802. lx standard to enhance user authentication. Use the built-in user profile database to authenticate up to 8 users using MD5 encryption. Use an EAP-compatible RADIUS (RFC2138,2139 - Remote Authentication Dial In User Service) server to authenticate a limitless number of users using EAP (Extensible Authentication Protocol). EAP is an authentication protocol that supports multiple types of authentication.

Wireless LAN MAC Address Filtering

Your WR1500 Wireless Router checks the MAC address of the wireless station against a list of allowed or denied MAC addresses.

Universal Plug and Play (UPnP)

Using the standard TCP/IP protocol, the WR1500 Wireless Router and other UPnP-enabled devices can dynamically join a network, obtain an IP address and convey its capabilities to other devices on the network.

Dynamic DNS Support

With Dynamic DNS support, you can have a static hostname alias for a dynamic IP address, allowing the host to be more easily accessible from various locations on the Internet. You must register for this service.

PPPoE Support (RFC2516)

PPPoE (Point-to-Point Protocol over Ethernet) emulates a dial-up connection. It allows your ISP to use their existing network configuration with newer broadband technologies such as ADSL. The PPPoE driver on the WR1500 Wireless Router is transparent to the computers on the LAN, which see only Ethernet and are not aware of PPPoE thus saving you from having to manage PPPoE clients on individual computers.

PPTP Encapsulation

Point-to-Point Tunneling Protocol (PPTP) is a network protocol that enables secure transfer of data from a remote client to a private server, creating a Virtual Private Network (VPN) using a TCP/IP-based network. PPTP supports on-demand, multi-protocol and virtual private networking over public networks, such as the Internet. Use PPTP to connect to a broadband modem to achieve access to high-speed data networks via a familiar “dial-up networking” user interface.

Network Address Translation (NAT)

NAT (Network Address Translation - NAT, RFC 1631) allows the translations of multiple IP addresses used within one network to different IP addresses known within another network.

NAT for Single-IP-address Internet Access

The WR1500 Wireless Router’s SUA (Single User Account) feature allows multiple-user Internet access for the cost of a single IP account. NAT supports popular Internet applications such as MS traceroute, CuSeeMe, IRC, RealPlayer, VDOLive, Quake, and PPTP. No configuration is needed to support these applications.

DHCP (Dynamic Host Configuration Protocol)

DHCP (Dynamic Host Configuration Protocol) allows the individual clients (computers) to obtain the TCP/IP configuration at start-up from a centralized DHCP server. The WR1500 Wireless Router has built-in DHCP server capability enabled by default. It can assign IP addresses, an IP default gateway and DNS servers to DHCP clients. The WR1500 Wireless Router also acts as a surrogate DHCP server (DHCP Relay) where it relays IP address assignment from the actual real DHCP server to the clients.

Multicast

Traditionally, IP packets are transmitted in two ways - unicast or broadcast. Multicast is a third way to deliver IP packets to a group of hosts. IGMP (Internet Group Management Protocol) is the protocol used to support multicast groups. The latest version is version 2 (see RFC 2236). The WR1500 Wireless Router supports versions 1 and 2.

IP Alias

IP Alias allows you to partition a physical network into logical networks over the same Ethernet interface. The WR1500 Wireless Router supports three logical LAN interfaces via its single physical Ethernet LAN interface with the WR1500 Wireless Router itself as the gateway for each LAN network.

IP Policy Routing

IP Policy Routing provides a mechanism to override the default routing behavior and alter packet forwarding based on the policies defined by the network administrator.

- Continued

SNMP

SNMP (Simple Network Management Protocol) is a protocol used for exchanging management information between network devices. SNMP is a member of the TCP/IP protocol suite. Your WR1500 Wireless Router supports SNMP agent functionality, which allows a manger station to manage and monitor the **SNMP.**

WR1500 Wireless Router through the network. The WR1500 Wireless Router supports SNMP version one (SNMPvl) and version two c (SNMPv2c).

Full Network Management

The embedded web configurator is an all-platform web-based utility that allows you to easily access the WR1500 Wireless Router's management settings. Most functions of the WR1500 Wireless Router are also software configurable via the SMT(System Management Terminal) interface. The SMT is a menu-driven interface that you can access from a terminal emulator through the console port or over a telnet connection.

- Logging and Tracing
- Built-in message logging and packet tracing.
- Unix syslog facility support.
- Diagnostics Capabilities

The WR1500 Wireless Router can perform self-diagnostic tests. These tests check the integrity of the following circuitry:

- FLASH memory
- DRAM
- LAN port
- Wireless port

Embedded FTP and TFTP Servers

The WR1500 Wireless Router's embedded FTP and TFTP servers enable fast firmware upgrades as well as configuration file backups and restoration.

Wireless Association List

With the Wireless Association List, you can see the list of the wireless stations that are currently using the WR1500 Wireless Router to access your wired network.

Wireless LAN Channel Usage

The Wireless Channel Usage displays whether the radio channels are used by other wireless devices within the transmission range of the WR1500 Wireless Router. This allows you to select the channel with minimum interference for your WR1500 Wireless Router.

1.3 Application for the WR1500 Wireless Router

Here is an application example of what you can do with your WR1500 Wireless Router.

1.3.1 Internet Access Application

Add a wireless LAN to your existing network without expensive network cables. Wireless stations can move freely anywhere in the coverage area and use resources on the wired network.

Internet Access Application Example

1.4 Installing Your WR1500 Wireless Router

This section will show you how to physically hook up your WR1500 Wireless Router.

1.4.1 Installation Options

The WR1500 is a powerful, feature-rich wireless router that can be used in a variety of installation schemes.

The following sections will detail the most common installation schemes. More advanced setups are explained in detail in later chapters of this manual.

1.4.2 Box Contents

The box your WR1500 came in should contain the following items:

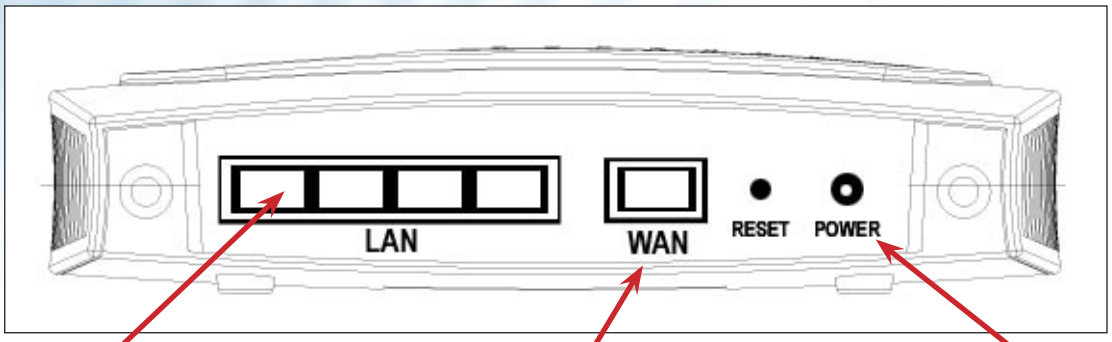
- WR1500 Wireless Router Unit
- Two Antennas
- One CAT-5 Ethernet Cable
- One AC Power Adapter
- Printed Quick Start Guide
- CD ROM containing the electronic version of this manual

1.4.3 What You Will Need to Install and Setup the WR1500

It is possible to setup the WR1500 using an existing Wi-Fi connected computer or laptop. However, for security reasons it is advised that you perform the initial setup using a computer that is connected to the WR1500 with a common CAT-5 Ethernet Cable, as shown below.

1.4.3 Connecting the WR1500 to Your Computer for Initial Configuration

The rear panel of the WR1500 contains several ports, as described below:



Plug your computer's Ethernet cable into Port 1. The remaining ports can to be used with other computers in a hard-wired router fashion

Plug your cable or DSL modem's Ethernet Cable into this port

Plug the AC Adapter into this port.

For initial setup, you should have:

- The power adapter plugged into the WR1500 as shown, and this adapter plugged into a surge-protected electrical outlet.
- Your Cable or DSL modem's Ethernet cable plugged into the Internet In port as shown above.
- An Ethernet cable plugged into the router port 1 as shown above, and the other end of this cable plugged into your computer's Ethernet port.

Now Proceed to the Next Page to Begin Setting Up Your WR1500.

Chapter 2: Introducing the Web Configuration Utility

This chapter describes how to access the WR1500 Wireless Router Web Configuration Utility and provides an overview of its screens.

2.1 Web Configuration Utility Overview

The Web Configuration Utility makes it easy to configure and manage the WR1500 Wireless Router. The screens you see in the Web Configuration Utility may vary somewhat from the ones shown in this document due to differences between individual WR1500 Wireless Router models or firmware versions.

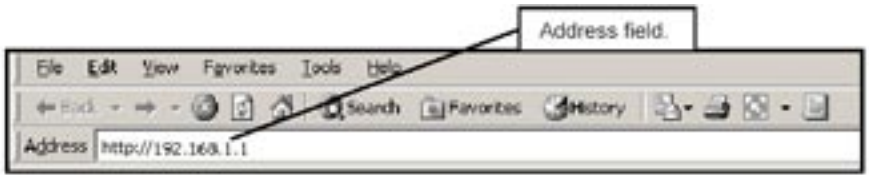
2.2 Accessing the WR1500 Wireless Router Web Configuration Utility

Step 1. Make sure your WR1500 Wireless Router hardware is properly connected (refer to the Chapter 1 of this manual).

Step 2. Prepare your computer to connect to the WR1500 Wireless Router (refer to the Setting Up Your Computer's IP Address appendix).

Step 3. Launch your web browser.

Step 4. Type "http://192.168.1.1" as the URL Address field.



Step 5. Type "1234" (default) as the password and click Login. In some versions, the default password appears automatically - if this is the case, click Login.

Step 6. You should see a screen asking you to change your password (highly recommended) as shown next. Type a new password (and retype it to confirm) and click Apply or click Ignore to allow access without password change.

Note - If the default password of "1234" is not accepted, refer to Section 2.3.1 on page 18 of this manual and go through the reset procedure to set all parameters back to factory defaults.

Then try the above steps again.

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2.2 Accessing the WR1500 Wireless Router Web Configuration Utility - Continued

Step 7. You should now see the MAIN MENU screen.

The WR1500 Wireless Router automatically times out after five minutes of inactivity. Simply log back into the WR1500 Wireless Router if this happens to you.

2.3 Resetting the WR1500 Wireless Router

The WR1500 ships with an internal IP address of 192.168.1.1, which certain cable/DSL modems may also utilize. If your cable/DSL modem has the same IP address as the WR1500 (192.168.1.1) you will not be able to connect during setup. ParkerVision has already performed this procedure on your WR1500, however, **IF YOU RESET** the WR1500 to factory defaults you will need to repeat the following procedure.

Please reference "Step 2" in the WR1500 Quick Start Guide for the following process:

Step 1. Ensure the cable/DSL modem is not connected to the WR1500, if it is, disconnect it now.

Step 2. Power the WR1500 by plugging the adapter into a surge-protected electrical outlet.

Step 3. Connect the provided Ethernet cable into port 1 on the WR1500 and the other end of the cable into your computer's Ethernet port.

Step 4. Reset the WR1500 by depressing the Reset button (located on the back of the unit) using a paper clip or pen until the system light on the top of the unit begins to flash red. Once the system light begins to flash red, release the Reset button.

Step 5. After reset, the system light will turn green indicating normal operation.

Please reference "Step 3" in the WR1500 Quick Start Guide to prepare your computer to connect to the WR1500.

Step 1. *Launch your web browser.*

Step 2. Type http://192.168.1.1 in the Address field of the web browser, and press enter on your computer.

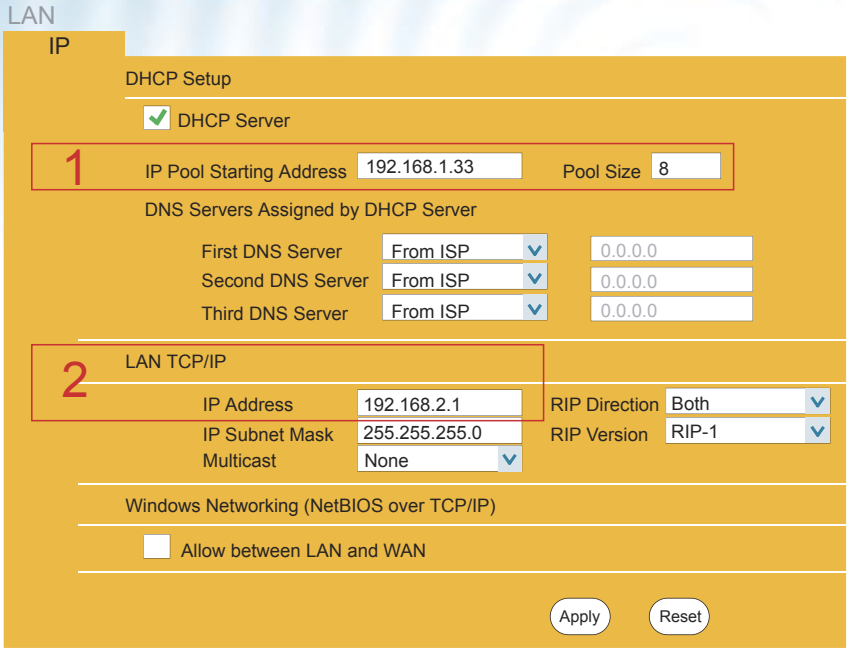
Step 4. The WR1500 Web Configuration Utility will load. Type the password 1234 in the Password box and hit enter to log in to the router.

Step 5. The main menu options are located on the left side of the screen. Click Advanced to open its submenus; the System screen will load. Click LAN, located underneath the Advanced menu, to proceed.

Continued next page

Next, you will need to change the IP Address.

Step 1. On the LAN screen, change the IP Pool Starting Address (Box 1 on the illustration below; 192.168.1.33 by default) to the recommended setting of 192.168.2.33.



Step 2. Change the IP Address (Box 2 on the illustration below; set to 192.168.1.1 by default) to the recommended setting of 192.168.2.1.

Step 3. Click Apply at the bottom of the screen to save the settings. Clicking Apply will cause you to lose your connection to the Web Configuration Utility.

Step 4. Turn off power to both the WR1500 and cable/DSL modem.

Reconnecting the cable/DSL modem

Step 1. While both are powered off, reconnect the cable/DSL modem to the WAN port on the WR1500. *(see Step 1 and Step 2 in the WR1500 Quick Start Guide).*

Step 2. Power the router back on, wait until the status lights are normal.

Step 3. Power the cable/DSL modem.

After you have performed these steps you should reboot the computer and test the LAN/WAN connectivity. If you are still having issues, ParkerVision Technical Support is available at 800.231.1759 or at support@parkervision.com.

Resetting the WR1500 Wireless Router - Continued

If you forget your password or cannot access the WR1500 Wireless Router, you will need to reload the factory-default configuration file or use the RESET button on the side panel of the WR1500 Wireless Router. Uploading this configuration file replaces the current configuration file with the factory-default configuration file. This means that you will lose all configurations that you had previously and the speed of the console port will be reset to the default of 9600bps with 8 data bit, no parity, one stop bit and flow control set to none. The password will be reset to “1234”, also.

2.3.1 Procedure to Use the Reset Button

Make sure the SYS LED is on (not blinking) before you begin this procedure.

Step 1. Press the RESET button for more than five seconds, and then release it. If the SYS LED begins to blink, the defaults have been restored and the WR1500 Wireless Router restarts. Otherwise, go to step 2.

Step 2. Turn the WR1500 Wireless Router off.

Step 3. While pressing the RESET button, turn the WR1500 Wireless Router on.

Step 4. Continue to hold the RESET button. The SYS LED will begin to blink and flicker very quickly after about 10 or 15 seconds. This indicates that the defaults have been restored and the WR1500 Wireless Router is now restarting.

Step 5. Release the RESET button and wait for the WR1500 Wireless Router to finish restarting.

2.3.2 Uploading a Configuration File via Console Port

This method is only applicable to WR1500 Wireless Router models with a console port.

.

Step 1. Download the default configuration file from the WR1500 Wireless Router FTP site, unzip it and save it in a folder.

Step 2. Turn off the WR1500 Wireless Router, begin a terminal emulation software session and turn on the WR1500 Wireless Router again.

When you see the message “Press any key to enter Debug Mode within 3 seconds”, press any key to enter debug mode.

Step 3. Enter “y” at the prompt below to go into debug mode.

Step 4. Enter “atlc” after “Enter Debug Mode” message.

Continued on next page

2.3.2 Uploading a Configuration File via Console Port - Continued

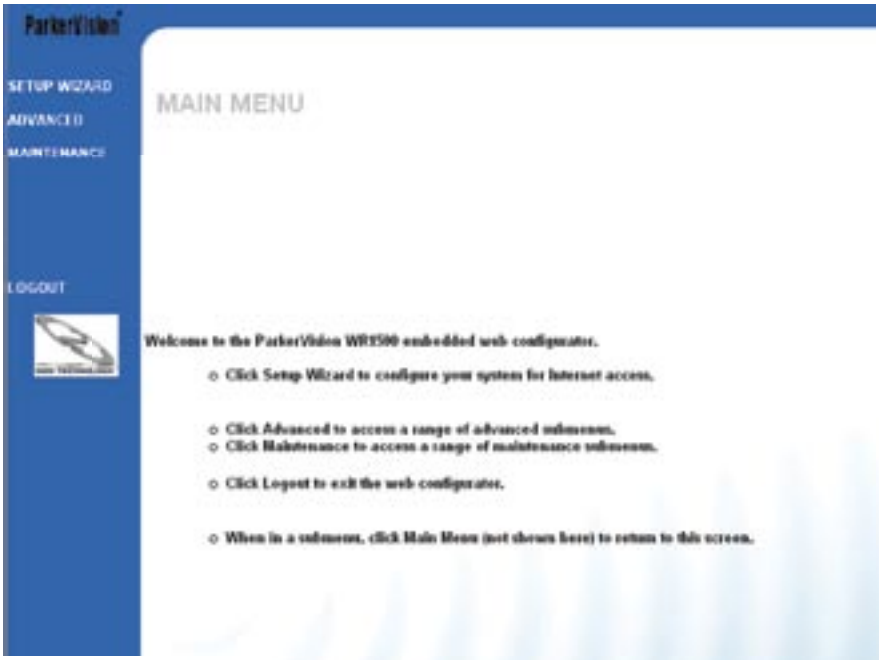
Step 5. Wait for “Starting XMODEM upload” message before activating Xmodem upload on your terminal. This is an example Xmodem configuration upload using HyperTerminal.

Step 6. Click Transfer, then Send File to display the following screen.

Step 7. After successful firmware upload, enter “atgo” to restart the WR1500 Wireless Router.

2.4 Navigating the WR1500 Wireless Router Web Configuration Utility

From the MAIN MENU screen below, you will be able to navigate the Web Configuration Utility. Follow the instructions you see in the MAIN MENU screen or click the IBs] icon (located in the top right corner of most screens) to view online help.



Chapter 3:
Wizard Setup

This chapter provides information on the Wizard Setup screens in the Web Configuration Utility.

3.1 Wizard Setup Overview

The Web Configuration Utility's setup wizard helps you configure your WR1500 Wireless Router for Internet access and set up wireless LAN.

3.1.1 Channel

The range of radio frequencies used by IEEE 802.1 lb wireless devices is called a "channel". Channels available depend on your geographical area. You may have a choice of channels (for your region) so you should use a different channel than an adjacent AP (Wireless Router) to reduce interference. Interference occurs when radio signals from different Wireless Routers overlap causing interference and degrading performance.

Adjacent channels partially overlap however. To avoid interference due to overlap, your AP should be on a channel at least five channels away from a channel that an adjacent AP is using. For example, if your region has 11 channels and an adjacent AP is using channel 1, then you need to select a channel between 6 or 11.

The WR1500 Wireless Router's "Scan" function is especially designed to automatically scan for a channel with the least interference.

3.1.2 ESSID

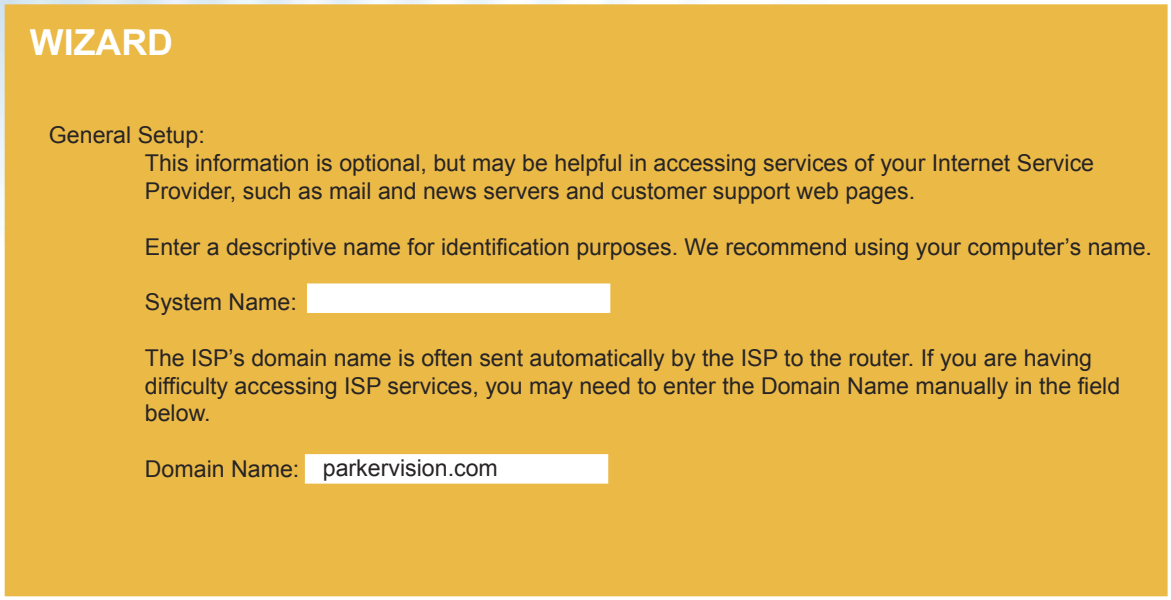
An Extended Service Set (ESS) is a group of Wireless Routers or wireless gateways connected to a wired LAN on the same subnet. An ESS ID uniquely identifies each set. All Wireless Routers or wireless gateways and their associated wireless stations in the same set must have the same ESSID.

3.1.3 WEP Encryption

WEP (Wired Equivalent Privacy) encrypts data frames before transmitting over the wireless network. WEP encryption scrambles the data transmitted between the wireless stations and the Wireless Routers to keep network communications private. It encrypts unicast and multicast communications in a network. Both the wireless stations and the Wireless Routers must use the same WEP key for data encryption and decryption.

3.2 Wizard Setup: General Setup

General Setup contains administrative and system-related information.

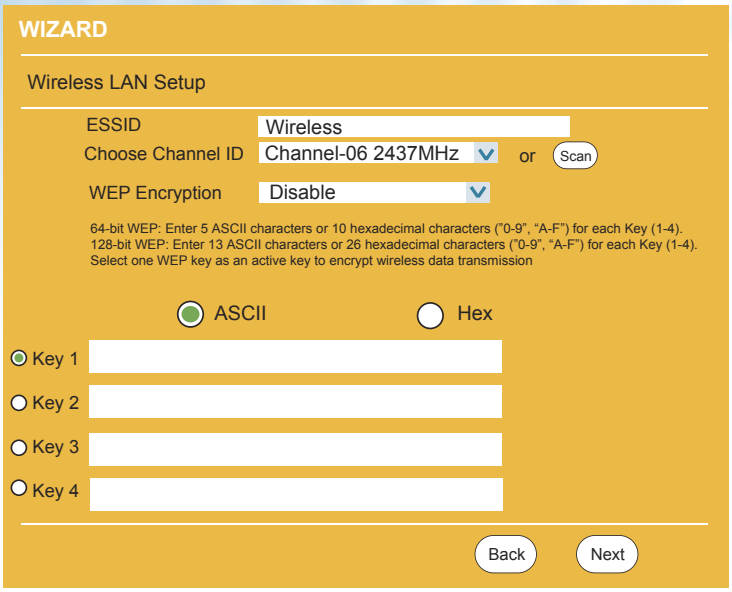

WIZARD
General Setup:
This information is optional, but may be helpful in accessing services of your Internet Service Provider, such as mail and news servers and customer support web pages.
Enter a descriptive name for identification purposes. We recommend using your computer's name.
System Name:
The ISP's domain name is often sent automatically by the ISP to the router. If you are having difficulty accessing ISP services, you may need to enter the Domain Name manually in the field below.
Domain Name:
parkervision.com

The following table describes the labels in this screen.

LABEL	DESCRIPTION
System Name	It is recommended you type your computer's "Computer name", some ISPs check this name you should enter your computer's "Computer Name". > In Windows 2000, click **Start, Settings, Control Panel** and then double-click **System.** Click the **Network Identification** tab and then the **Properties** button. Note the entry for the **Computer name** field and enter it as the **System Name.** > In Windows XP, click **Start, My Computer, View system information** and then click the **Computer Name** tab. Note the entry in the **Full computer name** field and enter it as the WR1500 Wireless Router **System Name.** This name can be up to 30 alphanumeric characters long. Spaces are not allowed, but dashes"-" and underscores"_" are accepted.
Domain Name	The **Domain Name** entry is what is propagated to the DHCP clients on the LAN. Type the domain name (if you know it) here. If you leave this field blank, the ISP may assign a domain name via DHCP. The domain name entered by you is given priority over the ISP assigned domain name.
Next	Click **Next** to proceed to the next screen.

3.3 Wizard Setup: Wireless LAN Setup

Set up your wireless LAN using the second wizard screen.



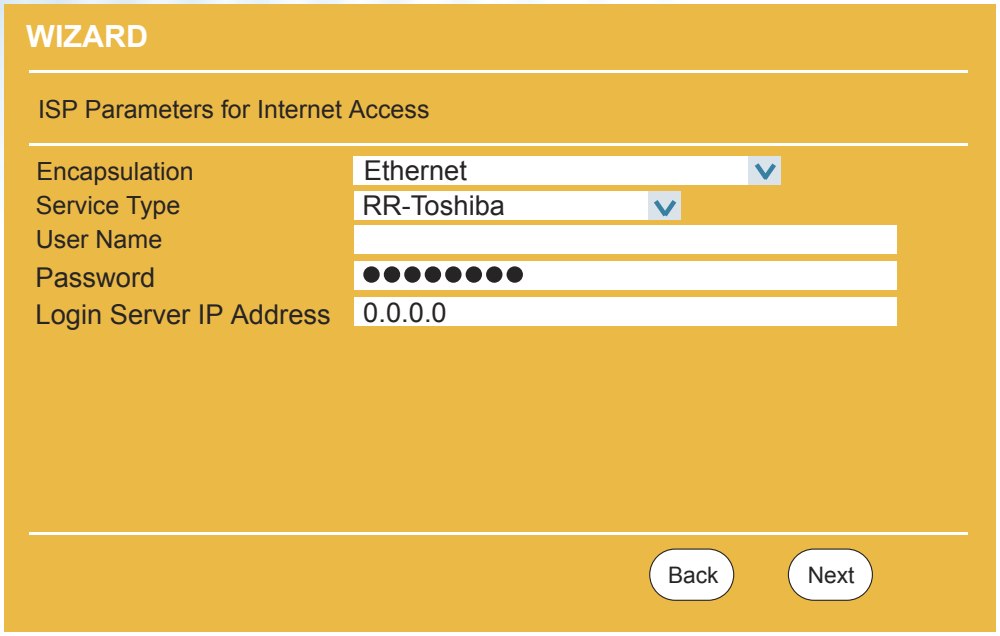
LABEL	DESCRIPTION
ESSID	Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN. If you change this field on the WR1500 Wireless Router, make sure all wireless stations use the same ESSID in order to access the network.
Choose Channel ID	To manually set the WR1500 Wireless Router to use a channel, select a channel from the drop-down list box. Open the **Channel Usage Table** screen to make sure the channel is not already used by another AP or independent peer-to-peer wireless network. To have the WR1500 Wireless Router automatically select a channel, click **Scan** instead.
Scan	Click this button to have the WR1500 Wireless Router automatically scan for and select a channel with the least interference.
WEP Encryption	Select **Disable** allows all wireless computers to communicate with the Wireless Routers without any data encryption. Select **64-bit WEP** or **128-bit WEP** to allow data encryption.
ASCII	Select this option in order to enter ASCII characters as the WEP keys.
HEX	Select this option to enter hexadecimal characters as the WEP keys. The preceding "Ox" is entered automatically. Leave this in front of your key.
Key 1 to Key 4	used to encrypt data. Both the WR1500 Wireless Router and the wireless stations must use the same WEP key for data transmission. If you chose **64-bit WEP,** then enter any 5 ASCII characters or 10 hexadecimal characters ("0-9", "A-F"). If you chose **128-bit WEP,** then enter 13 ASCII characters or 26 hexadecimal characters ("0-9", "A-F"). You must configure all four keys, but only one key can be activated at any one time. The default key is key 1.
Next	Click **Next** to continue.
Back	Click **Back** to return to the previous screen.

Refer to the chapter on wireless LAN for more information.

3.4 Wizard Setup: ISP Parameters

The WR1500 Wireless Router offers three choices of encapsulation. They are Ethernet, PPTP or PPPoE. The screen varies depending upon the type chosen.

3.4.1 Ethernet



The following table describes the labels in this screen.

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	You must choose the **Ethernet** option when the WAN port is used as a regular Ethernet. Otherwise, choose **PPPoE** or **PPTP** for a dial-up connection.
Service Type	Select from **Standard, RR-Toshiba** (RoadRunner Toshiba authentication method), **RR-Manager** (Roadrunner Manager authentication method), **RR-Telstra** or **Telia Login.** Choose a Roadrunner service type if your ISP is Time Warner's Roadrunner; otherwise choose **Standard.** The **User Name, Password** and **Login Server IP Address** fields are not applicable **(N/A)** for the **Standard** service type.

Continued next page

3.4.1 Wizard Setup - Ethernet - Continued

LABEL	DESCRIPTION
User Name	Type the username given to you by your ISP.
Password	Type the password associated with the username above.
Login Server IP Address	The WR1500 Wireless Router will find the Roadrunner Server IP if this field is left blank. If it does not, then you must enter the authentication server IP address.
Login Server (Telia Login only)	Type the domain name of the Telia login server, for example "logini .telia.com". This field is not available on all models.
Relogin Every(min) (Telia Login only)	The Telia server logs the WR1500 Wireless Router out if the WR1500 Wireless Router does not log in periodically. Type the number of minutes from 1 to 59 (30 recommended) for the WR1500 Wireless Router to wait between logins. This field is not available on all models.
Next	Click **Next** to proceed to the next page.
Back	Click Back to go back to the previous page.

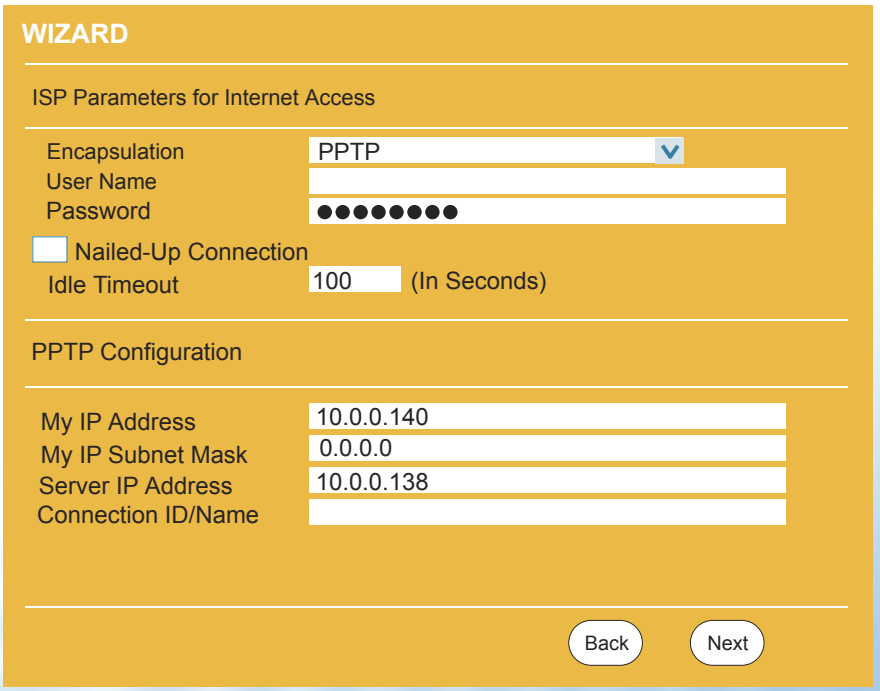
3.4.2 PPTP Encapsulation

Point-to-Point Tunneling Protocol (PPTP) is a network protocol that enables transfers of data from a remote client to a private server, creating a Virtual Private Network (VPN) using TCP/IP-based networks.

PPTP supports on-demand, multi-protocol, and virtual private networking over public networks, such as the Internet.

Refer to the appendix for more information on PPTP.

The WR1500 Wireless Router supports one PPTP server connection at any given time.



3.4.2 PPTP Encapsulation - Continued

The following table describes the labels in the screen on the previous page.

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	Select **PPTP** from the drop-down list box.
User Name	Type the user name given to you by your ISP. Most home user will need to use their name with their domain designation, such as user@bellsouth.net
Password	Type the password associated with the User Name above.
Nailed Up Connection	Select **Nailed Up Connection** if you do not want the connection to time out.
Idle Timeout	Type the time in seconds that elapses before the WR1500 Wireless Router automatically disconnects from the PPTP server.
PPTP Configuration	
My IP Address	Type the (static) IP address assigned to you by your ISP.
My IP Subnet Mask	Type the subnet mask assigned to you by your ISP (if given).
Server IP Address	Type the IP address of the PPTP server.
Connection ID/Name	If your ISP has provided a connection ID name, enter it in this field exactly as provided.
Next	Click **Next** to continue.
Back	Click **Back** to return to the previous screen.

3.4.3 PPPoE Encapsulation

Point-to-Point Protocol over Ethernet (PPPoE) functions as a dial-up connection. PPPoE is an IETF (Internet Engineering Task Force) draft standard specifying how a host personal computer interacts with a broadband modem (for example xDSL, cable, wireless, etc.) to achieve access to high-speed data networks. It preserves the existing Microsoft Dial-Up Networking experience and requires no new learning or procedures.

For the service provider, PPPoE offers an access and authentication method that works with existing access control systems (for instance, RADIUS). For the user, PPPoE provides a login and authentication method that the existing Microsoft Dial-Up Networking software can activate, and therefore requires no new learning or procedures for Windows users.

One of the benefits of PPPoE is the ability to let end users access one of multiple network services, a function known as dynamic service selection. This enables the service provider to easily create and offer new IP services for specific users.

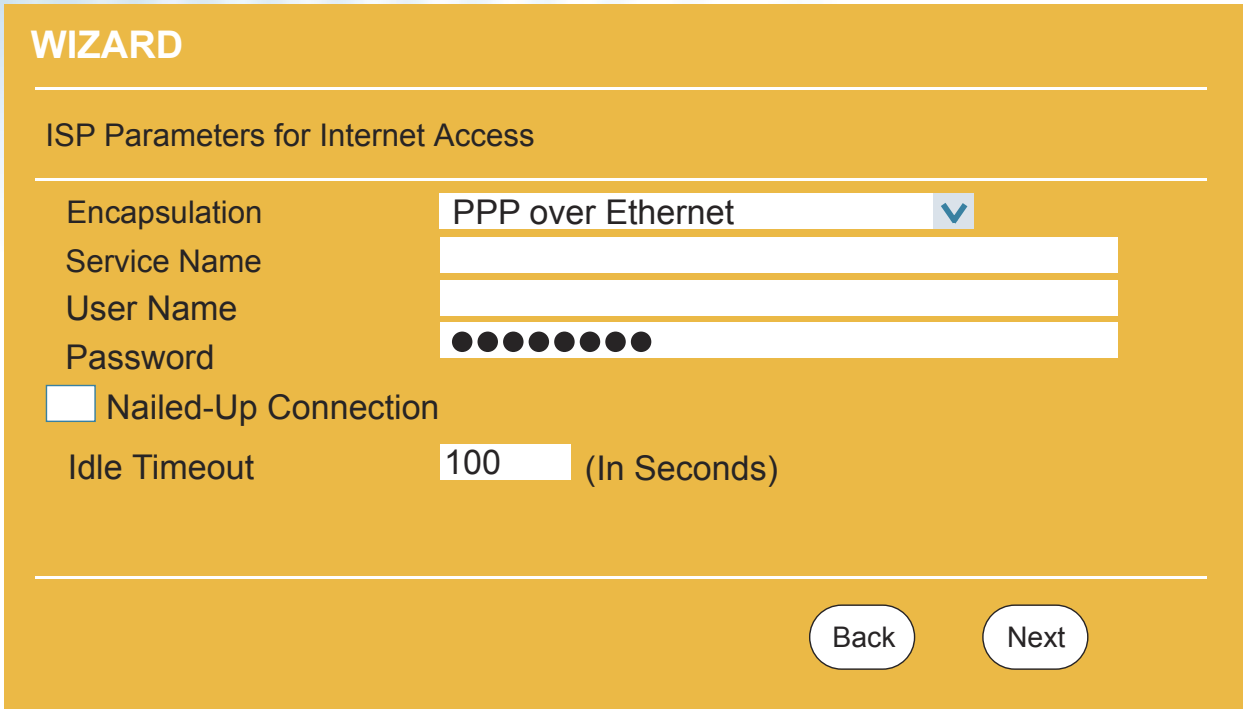
Operationally, PPPoE saves significant effort for both the subscriber and the ISP/carrier, as it requires no specific configuration of the broadband modem at the subscriber's site.

By implementing PPPoE directly on the WR1500 Wireless Router (rather than individual computers), the computers on the LAN do not need PPPoE software installed, since the WR1500 Wireless Router does that part of the task. Furthermore, with NAT, all of the LAN's computers will have Internet access.

Refer to the appendix for more information on PPPoE, and to the next page for setup details.

3.4.3 PPPoE Encapsulation - Continued

PPoE Wizard Setup Screen



The following table describes the labels in this screen.

LABEL	DESCRIPTION
ISP Parameter for Internet Access	
Encapsulation	Choose an encapsulation method from the pull-down list box. PPPoE forms a dial-up connection.
Service Name	Type the name of your service provider.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the user name above.
Nailed Up Connection	Select **Nailed Up Connection** if you do not want the connection to time out.
Idle Timeout	Type the time in seconds that elapses before the WR1500 Wireless Router automatically disconnects from the PPPoE server.
Next	Click **Next** to continue.
Back	Click **Back** to return to the previous screen.

3.5 Wizard Setup: WAN and DNS

The fourth wizard screen allows you to configure WAN IP address assignment, DNS server address assignment and the WAN MAC address.

3.5.1 WAN IP Address Assignment

Every computer on the Internet must have a unique IP address. If your networks are isolated from the Internet, for instance, only between your two branch offices, you can assign any IP addresses to the hosts without problems. However, the Internet Assigned Numbers Authority (IANA) has reserved the following three blocks of IP addresses specifically for private networks.

10.0.0.0	-	10.255.255.255
172.16.0.0	-	172.31.255.255
192.168.0.0	-	192.168.255.255

You can obtain your IP address from the IANA, from an ISP or have it assigned by a private network. If you belong to a small organization and your Internet access is through an ISP, the ISP can provide you with the Internet addresses for your local networks. On the other hand, if you are part of a much larger organization, you should consult your network administrator for the appropriate IP addresses.

Regardless of your particular situation, do not create an arbitrary IP address; always follow the guidelines above. For more information on address assignment, please refer to RFC 1597, Address Allocation for Private Internets and RFC 1466, Guidelines for Management of IP Address Space.

3.5.2 IP Address and Subnet Mask

Similar to the way houses on a street share a common street name, so too do computers on a LAN share one common network number. Where you obtain your network number depends on your particular situation. If the ISP or your network administrator assigns you a block of registered IP addresses, follow their instructions in selecting the IP addresses and the subnet mask.

If the ISP did not explicitly give you an IP network number, then most likely you have a single user account and the ISP will assign you a dynamic IP address when the connection is established. If this is the case, it is recommended that you select a network number from 192.168.0.0 to 192.168.255.0 and you must enable the Network Address Translation (NAT) feature of the WR1500 Wireless Router. The Internet Assigned Number Authority (IANA) reserved this block of addresses specifically for private use; please do not use any other number unless you are told otherwise. Let's say you select 192.168.1.0 as the network number; which covers 254 individual addresses, from 192.168.1.1 to 192.168.1.254 (zero and 255 are reserved). In other words, the first three numbers specify the network number while the last number identifies an individual computer on that network.

Once you have decided on the network number, pick an IP address that is easy to remember, for instance, 192.168.1.1, for your WR1500 Wireless Router, but make sure that no other device on your network is using that IP address.

Continued on next page

3.5.2 IP Address and Subnet Mask-Continued

The subnet mask specifies the network number portion of an IP address. Your WR1500 Wireless Router will compute the subnet mask automatically based on the IP address that you entered. You don't need to change the subnet mask computed by the WR1500 Wireless Router unless you are instructed to do otherwise.

3.5.3 DNS Server Address Assignment

Use DNS (Domain Name System) to map a domain name to its corresponding IP address and vice versa. For instance, the IP address of a web site with an URL of www.anycompany.com could be 192.168.3.1. The DNS server is extremely important because without it, you must know the IP address of a computer before you can access it.

There are two ways that an ISP disseminates the DNS server addresses.

1. The ISP tells you the DNS server addresses, usually in the form of an information sheet, when you sign up. If your ISP gives you DNS server addresses, enter them in the DNS Server fields in DHCP Setup.

2. Leave the DNS Server fields in DHCP Setup blank (for example 0.0.0.0). The WR1500 Access Point acts as a DNS proxy when this field is blank.

3.5.4 WAN MAC Address

Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0: C5:00:00:02.

You can configure the WAN port's MAC address by either using the factory default or cloning the MAC address from a workstation on your LAN. Once it is successfully configured, the address will be copied to the "rom" file (ZyNOS configuration file). It will not change unless you change the setting or upload a different "rom" file.

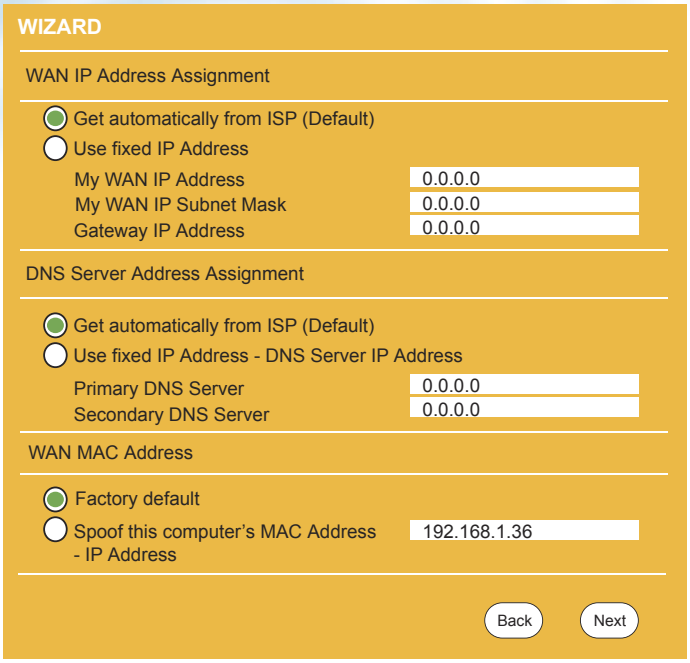
ParkerVision recommends you clone the MAC address from a workstation on your LAN even if your ISP does not require MAC address authentication.

Your WR1500 Wireless Router WAN port is always set at half-duplex mode as most cable/DSL modems only support half-duplex mode. Make sure your modem is in half-duplex mode. Your WR1500 Wireless Router supports full duplex mode on the LAN side.

Example of Network Properties for LAN Servers with Fixed IP Addresses:

Choose an IP address	192.168.1.2-192.168.1.32; 192.168.1.65-192.168.1.254.
Subnet mask	255.255.255.0
Gateway (or default route)	192.168.1.1(WR1500 Wireless RouterLANIP)

3.5.4 WAN MAC Address - Continued



The following table describes the labels in the screen above.

LABEL	DESCRIPTION
WAN IP Address Assignment	
Get automatically from ISP	Select this option If your ISP did not assign you a fixed IP address. This is the default selection.
Use fixed IP address	Select this option If the ISP assigned a fixed IP address.
My WAN IP Address	Enter your WAN IP address in this field if you selected **Use Fixed IP Address.**
My WAN IP Subnet Mask	Enter the IP subnet mask in this field if you selected **Use Fixed IP Address.** This field is not available when you select PPPoE encapsulation in the previous wizard screen.
Gateway IP Address	Enter the gateway IP address in this field if you selected **Use Fixed IP Address.** This field is not available when you select PPPoE encapsulation in the previous wizard screen.
DNS Server Address Assignment	
Get automatically from ISP	Select this option if your ISP does not give you DNS server addresses. This option is selected by default.
Use fixed IP address -DNS Server IP Address	Select this option If your ISP provides you a DNS server address.
Primary/Secondary DNS Server	If you selected the **Use fixed IP address - Primary/Secondary DNS Server** option, enter the provided DNS addresses in these fields.
WAN MAC Address: The MAC address field allows you to configure the WAN port's MAC address by either using the factory default or cloning the MAC address from a workstation on your LAN.	
Factory Default	Select this option to use the factory assigned default MAC address.
Spoof this Computer's MAC address - IP Address	Select this option and enter the IP address of the computer on the LAN whose MAC address you are cloning. Once it is successfully configured, the MAC address will be copied to the rom file (ZyNOS configuration file). It will not change unless you change the setting or upload a different rom file. It is advisable to clone the MAC address from a computer on your LAN even if your ISP does not presently require MAC address authentication.
Back	Click **Back** to return to the previous screen.
Next	Click **Next** to continue.

3.6 Basic Setup Complete

Click **Finish** to complete and save the wizard setup.

If you are currently using a wireless (LAN) adapter to access this WR1500 Router/Wireless Router and you made changes to the ESSID, then you will need to make the same changed to your wireless (LAN) adapter after you click the Finish button.

Part II

System, LAN, and Wireless

This part discusses the System, LAN, and Wireless Setup Screens.

Chapter 4: System Screens

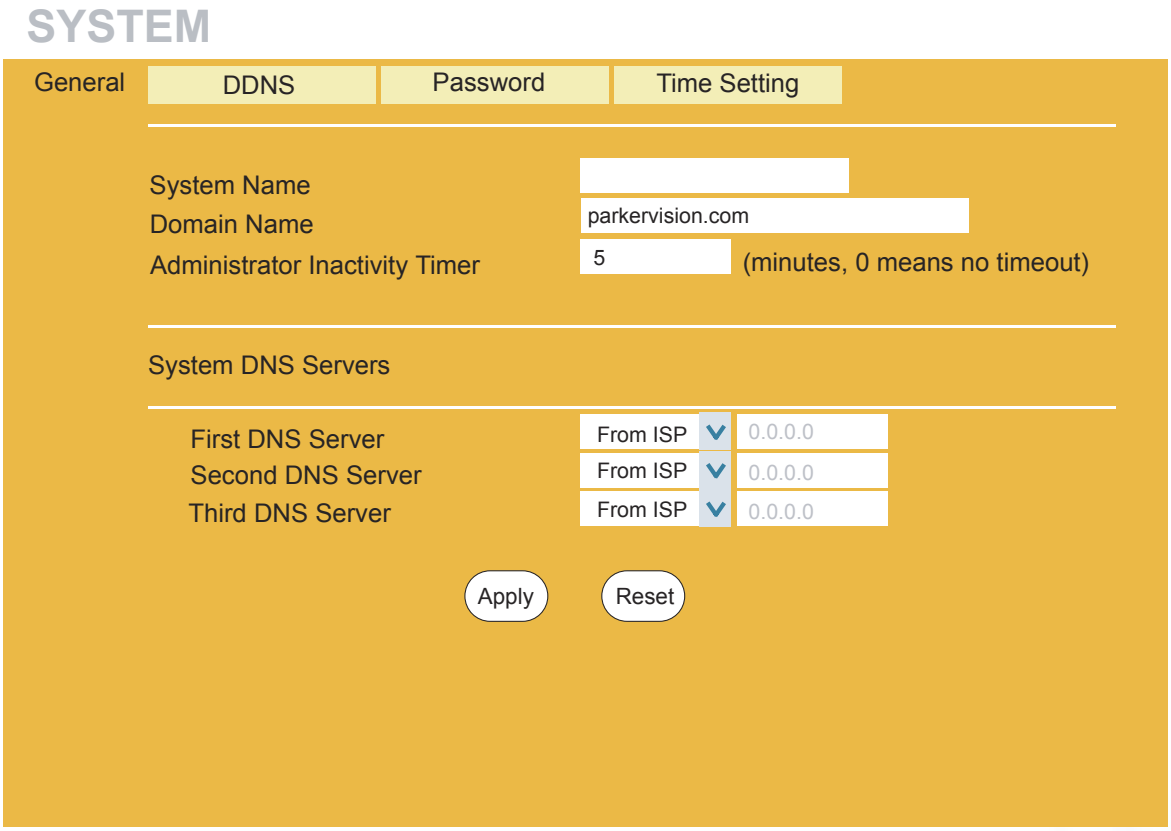
This chapter provides information on the System screens.

4.1 System Overview

This section provides information on general system setup.

4.2 Configuring General Setup

Click **ADVANCED** and then **SYSTEM** to open the **General** screen.



The table on the next page describes the labels in the above screen.

4.2 Configuring General Setup - Continued

LABEL	DESCRIPTION
System Name	Type a descriptive name for identification purposes. Some ISPs check this name, so it is recommended you enter your computer's "Computer name" This name can be up to 30 alphanumeric characters long. Spaces are not allowed, but dashes"-" and underscores"_" are accepted.
Domain Name	Type the domain name (if you know it) here. If you leave this field blank, the ISP may assign a domain name via DHCP. The domain name entered by you is given priority over the ISP assigned domain name.
Administrator Inactivity Timer	Type how many minutes a management session (either via the web configuration utility or SMT) can be left idle before the session times out. The default is 5 minutes. After it times out you have to log in with your password again. Very long idle timeouts may have security risks. A value of "0" means a management session never times out, no matter how long it has been left idle (not recommended).
System DNS Servers	
First DNS Server Second DNS Server Third DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the WR1500's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select **User-Defined** if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined,** but leave the IP address set to 0.0.0.0, **User-Defined** changes to **None** after you click **Apply.** If you set a second choice to **User-Defined,** and enter the same IP address, the second **User-Defined** changes to **None** after you click **Apply.** Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a machine in order to access it.
Apply	Click **Apply** to save your changes back to the WR1500.
Reset	Click **Reset** to reload the previous configuration for this screen.

4.3 Dynamic DNS

Dynamic DNS allows you to update your current dynamic IP address with one or many dynamic DNS services so that anyone can contact you (in NetMeeting, CU-SeeMe, etc.). You can also access your FTP server or web site on your own computer using a DNS-like address (for instance myhost.dhs.org, where myhost is a name of your choice) that will never change instead of using an IP address that changes each time you reconnect. Your friends or relatives will always be able to call you even if they don't know your IP address.

First of all, you need to have registered a dynamic DNS account with www.dyndns.org. This is for people with a dynamic IP from their ISP or DHCP server that would still like to have a DNS name. The dynamic DNS service provider will give you a password or key.

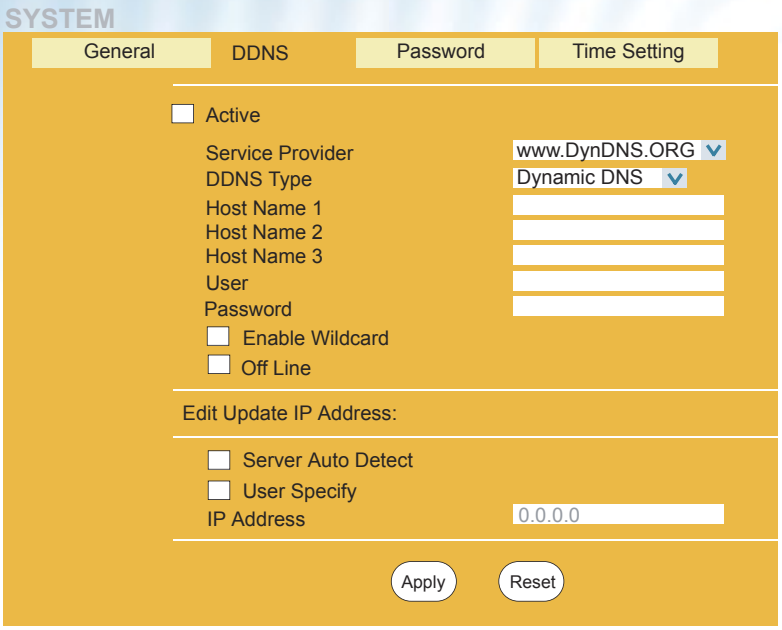
4.3.1 DYNDNS Wildcard

Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

If you have a private WAN IP address, then you cannot use Dynamic DNS.

4.4 Configuring Dynamic DNS

To change your WR1500's **DDNS**, click **ADVANCED**, **SYSTEM** and then the **DDNS** tab. The screen appears as shown.



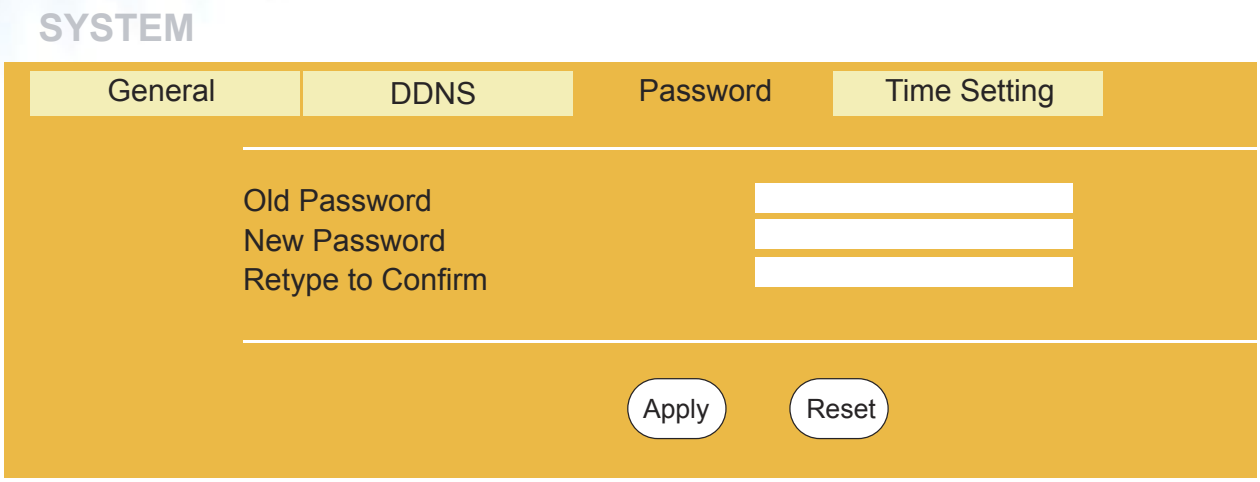
The following table describes the labels in this screen.

LABEL	DESCRIPTION
Active	Select this check box to activate DDNS.
Service Provider	Select the name of your DDNS service provider.
DDNS Type	Select the type of service that you are registered for from your DDNS service provider. Options are **Dynamic DNS, Static DNS** or **Custom DNS.**
Host Names 1-3	Enter your host names in the three fields provided. You can specify up to two host names in each field separated by a comma (",").
User	Type your user name.
Password	Type the password assigned to you.
Enable Wildcard	Your WR1500 supports DYNDNS wildcard. Select the check box to enable.
Off Line	This option is available when **CustomDNS** is selected in the **DDNS Type** field. Check with your dynamic DNS service provider to have traffic redirected to a URL (that you can specify) while you are off line.
Edit Update IP Address:	
Server Auto Detect	Select this option to update the IP address of the host name(s) automatically by the DDNS server. It is recommended that you select this option.
User Specify	Select this option to update the IP address of the host name(s) to the IP address specified below. Use this option if you have a static IP address.
IP Address	Enter the IP address if you select the **User Specify** option.
Apply	Click **Apply** to save your changes back to the WR1500.
Reset	Click **Reset** to reload the previous configuration for this screen.

4.5 Configuring Password

To change your router's password (recommended), click **ADVANCED**, **SYSTEM** and then the **Password** tab. The screen appears as shown. This screen allows you to change the router's password.

If you forget your password (or the WR1500 Wireless Routers IP address), you will need to reset the router or upload the default configuration file via console port. See the Resetting the Wireless Router section for details.

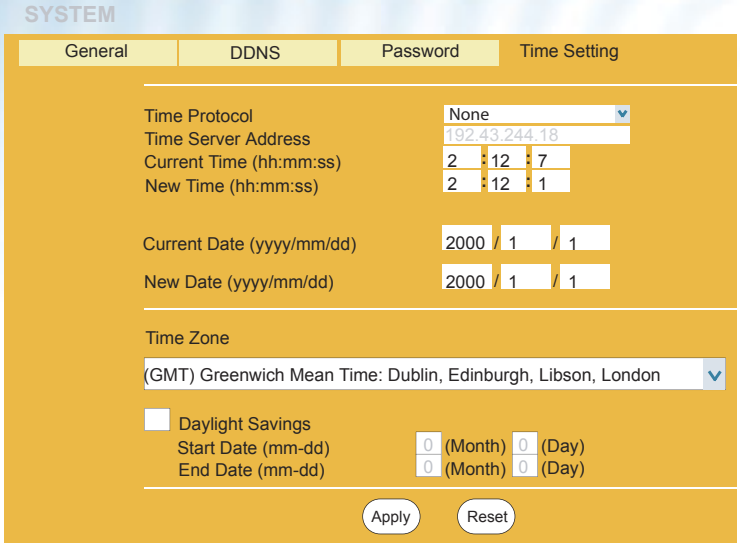


The following table describes the labels in this screen.

LABEL	DESCRIPTION
Old Password	Type in your existing system password (1234 is the default password).
New Password	Type your new system password (up to 31 characters). Note that as you type a password, the screen displays an asterisk (*) for each character you type.
Retype to Confirm	Retype your new system password for confirmation.
Apply	Click **Apply** to save your changes back to the WR1500 Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

4.6 Configuring Time Setting

To change your WR1500's time and date, click **ADVANCED**, **SYSTEM** and then the **Time Setting** tab. The screen appears as shown. Use this screen to configure the router time based on your local time zone.



The table below describes the labels in this screen.

LABEL	DESCRIPTION
Time Protocol	Select the time service protocol that your time server sends when you turn on the router. Not all time servers support all protocols, so you may have to check with your ISP/network administrator or use trial and error to find a protocol that works. The main difference between them is the format. **Daytime (RFC 867)** format is day/month/year/time zone of the server. **Time (RFC 868)** format displays a 4-byte integer giving the total number of seconds since 1970/1/1 at 0:0:0. The default, **NTP (RFC 1305),** is similar to Time (RFC 868). Select **None** to enter the time and date manually.
Time Server Address	Enter the IP address or the URL of your time server. Check with your ISP/network administrator if you are unsure of this information (the default is tick.stdtime.gov.tw).
Current Time (hh:mm:ss)	This field displays the time of your WR1500. Each time you reload this page, the WR1500 synchronizes the time with the time server.
New Time (hh:mm:ss)	This field displays the last updated time from the time server. When you select **None** in the **Time Protocol** field, enter the new time in this field and then click **Apply.**
Current Date (yyyy/mm/dd)	This field displays the date of your WR1500 Router. Each time you reload this page, the WR1500 Router synchronizes the time with the time server.
New Date (yyyy/mm/dd)	This field displays the last updated date from the time server. When you select **None** in the **Time Protocol** field, enter the new date in this field and then click **Apply.**
Time Zone	Choose the time zone of your location. This will set the time difference between your time zone and Greenwich Mean Time (GMT).
Daylight Savings	Select this option if you use daylight savings time. Daylight saving is a period from late spring to early fall when many countries set their clocks ahead of normal local time by one hour to give more daytime light in the evening.
Start Date (mm-dd)	Enter the month and day that your daylight-savings time starts on if you selected **Daylight Savings.**
End Date (mm-dd)	Enter the month and day that your daylight-savings time ends on if you selected **Daylight Savings.**
Apply	Click **Apply** to save your changes back to the WR1500 Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

Chapter 5: LAN Screens

This chapter describes how to configure LAN settings.

5.1 LAN Overview

Local Area Network (LAN) is a shared communication system to which many computers are attached. The LAN screens can help you configure a LAN DHCP server, manage IP addresses, and partition your physical network into logical networks.Please see the Wizard Setup chapter for the background information about Primary and Secondary DNS Server and IP Address and Subnet Mask.

5.2 LANs and WANs

A LAN is a computer network limited to the immediate area, usually the same building or floor of a building. A WAN (Wide Area Network), on the other hand, is an outside connection to another network or the Internet.

5.2.1 LANs, WANs and the WR1500 Wireless Router

The actual physical connection determines whether the WR1500 Wireless Router ports are LAN or WAN ports. There are two separate IP networks, one inside, the LAN network; the other outside: the WAN network as shown next:

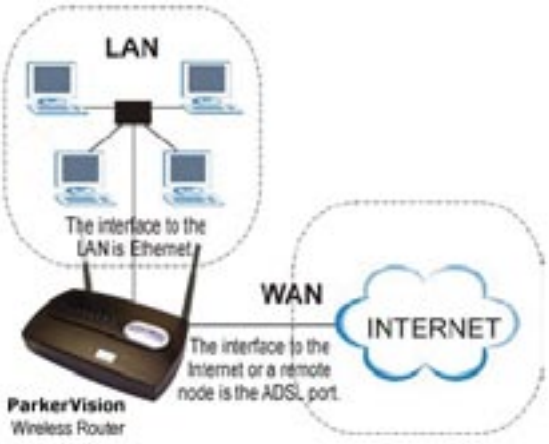


Figure 5-1 LAN & WAN IPs

5.3 DHCP Setup

DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients to obtain TCP/IP configuration at start-up from a server. You can configure the WR1500 Wireless Router as a DHCP server or disable it. When configured as a server, the WR1500 Wireless Router provides the TCP/IP configuration for the clients. If set to **None**, DHCP service will be disabled and you must have another DHCP server on your LAN, or else the computer must be manually configured.

5.4 Factory LAN Defaults

The LAN parameters of the WR1500 Wireless Router are preset in the factory with the following values:

- IP address of 192.168.1.1 with subnet mask of 255.255.255.0 (24 bits).
- DHCP server enabled with 8 client IP addresses starting from 192.168.1.33.

IP Pool Setup

The WR1500 Wireless Router is pre-configured with a pool of 8 IP addresses starting from 192.168.1.33 to 192.168.1.64. This configuration leaves 31 IP addresses (excluding the WR1500 Wireless Router itself) in the lower range for other server computers, for instance, servers for mail, FTP, TFTP, web, etc., that you may have.

These parameters should work for the majority of installations. If your ISP gives you explicit DNS server address(es), read the embedded Web Configuration Utility help regarding what fields need to be configured.

5.5 RIP Setup

RIP (Routing Information Protocol, RFC 1058 and RFC 1389) allows a router to exchange routing information with other routers. **RIP Direction** controls the sending and receiving of RIP packets. When set to:

1. **Both** - the WR1500 Wireless Router will broadcast its routing table periodically and incorporate the RIP information that it receives.

2. **In Only** - the WR1500 Wireless Router will not send any RIP packets but will accept all RIP packets received.

3. **Out Only** - the WR1500 Wireless Router will send out RIP packets but will not accept any RIP packets received.

4. **None** - the WR1500 Wireless Router will not send any RIP packets and will ignore any RIP packets received.

RIP Version controls the format and the broadcasting method of the RIP packets that the WR1500 Wireless Router sends (it recognizes both formats when receiving). **RIP-1** is universally supported; but **RIP-2** carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology.

Both **RIP-2B** and **RIP-2M** send routing data in **RIP-2** format; the difference being that RIP-2B uses subnet broadcasting while RIP-2M uses multicasting. Multicasting can reduce the load on non-router machines since they generally do not listen to the RIP multicast address and so will not receive the RIP packets. However, if one router uses multicasting, then all routers on your network must use multicasting, also.

By default, RIP Direction is set to **Both** and RIP Version to **RIP-1**.

5.6 Multicast

Traditionally, IP packets are transmitted in one of either two ways - **Unicast (1 sender -1 recipient)** or **Broadcast (1 sender - everybody on the network)**. Multicast delivers IP packets to a group of hosts on the network - not everybody and not just 1.

IGMP (Internet Group Multicast Protocol) is a network-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. **IGMP version 2 (RFC 2236)** is an improvement over version 1 (RFC 1112) but IGMP version 1 is still in wide use. If you would like to read more detailed information about interoperability between IGMP version 2 and version 1, please see sections 4 and 5 of RFC 2236.

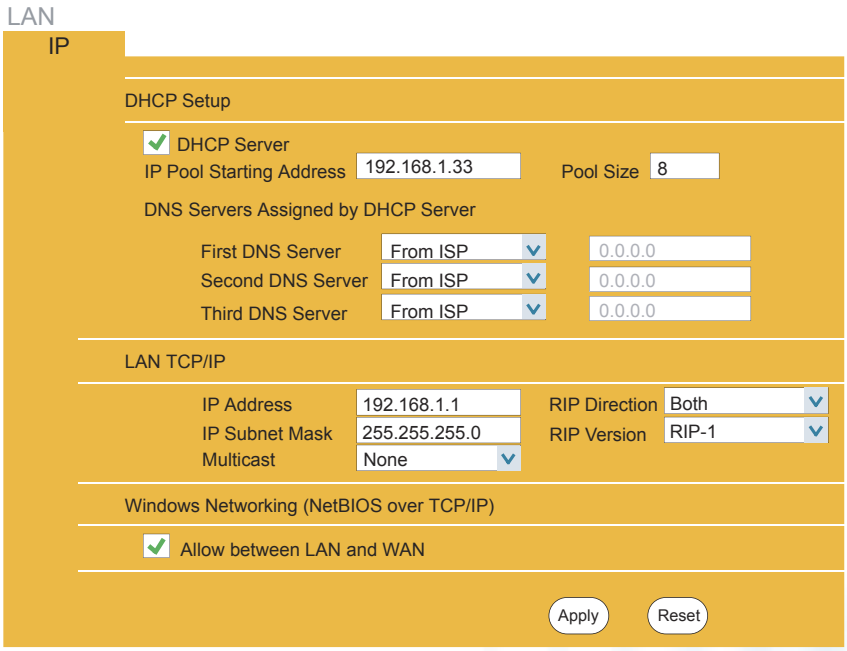
The class D IP address is used to identify host groups and can be in the range 224.0.0.0 to 239.255.255.255. The address 224.0.0.0 is not assigned to any group and is used by IP multicast computers. The address 224.0.0.1 is used for query messages and is assigned to the permanent group of all IP hosts (including gateways).

All hosts must join the 224.0.0.1 group in order to participate in IGMP. The address 224.0.0.2 is assigned to the multicast routers group.

The WR1500 Wireless Router supports both IGMP version 1 (IGMP-vl) and IGMP version 2 (IGMP-v2).

At start up, the WR1500 Wireless Router queries all directly connected networks to gather group membership. After that, the WR1500 Wireless Router periodically updates this information. IP multicasting can be enabled/disabled on the WR1500 Wireless Router LAN and/or WAN interfaces in the Web Configuration Utility (LAN; WAN). Select **None** to disable IP multicasting on these interfaces.

5.7 Configuring the LAN IP Screens



Click **ADVANCED** and then **LAN** to open the **IP Screen**.

This screen's options are described on the next page.

5.7 Configuring the LAN IP Screens - Continued

The following table describes the options of the LAN Screen, from the previous page.

LABEL	DESCRIPTION
DHCP Setup (refer to your User's Guide for background information)	
DHCP Server	Select this option to allow your WR1500 Wireless Router to assign IP addresses, an IP default gateway and DNS servers to Windows 95, Windows NT and other systems that support the DHCP client. When DHCP is used, the following items need to be set:
IP Pool Starting Address	This field specifies the first of the contiguous addresses in the IP address pool.
Pool Size	This field specifies the size or count of the IP address pool.
DNS Servers Assigned by DHCP Server	
First DNS Server Second DNS Server Third DNS Server	Select **From ISP** if your ISP dynamically assigns DNS server information (and the WR1500 Wireless Router's WAN IP address). The field to the right displays the (read-only) DNS server IP address that the ISP assigns. Select User-Defined if you have the IP address of a DNS server. Enter the DNS server's IP address in the field to the right. If you chose **User-Defined,** but leave the IP address set to 0.0.0.0, User-Defined changes to **None** after you click **Apply.** If you set a second choice to User-Defined, and enter the same IP address, the second User-Defined changes to **None** after you click **Apply.** Select **DNS Relay** to have the WR1500 Wireless Router act as a DNS proxy. The WR1500 Wireless Router's LAN IP address displays in the field to the right (read-only). The WR1500 Wireless Router tells the DHCP clients on the LAN that the WR1500 Wireless Router itself is the DNS server. When a computer on the LAN sends a DNS query to the WR1500 Wireless Router, the WR1500 Wireless Router forwards the query to the WR1500 Wireless Router's system DNS server (configured in the **SYSTEM General** screen) and relays the response back to the computer. You can only select **DNS Relay** for one of the three servers; if you select **DNS Relay** for a second or third DNS server, that choice changes to **None** after you click **Apply.** Select **None** if you do not want to configure DNS servers. If you do not configure a DNS server, you must know the IP address of a machine in order to access it.
LAN TCP/IP	
IP Address	Type the IP address of your WR1500 Wireless Router in dotted decimal notation, for example, 192.168.1.1 (factory default).
IP Subnet Mask	Type the subnet mask assigned to you by your ISP (if given).
RIP Direction	Select the RIP direction from **None, Both, In Only** and **Out Only.**
RIP Version	Select the RIP version from **RIP-1, RIP-2B** and **RIP-2M.**
Multicast	IGMP (Internet Group Multicast Protocol) is a session-layer protocol used to establish membership in a multicast group. The WR1500 Wireless Router supports both IGMP version 1 **(IGMP-v-l)** and **IGMP-v2.** Select **None** to disable it.
Windows Networking (NetBIOS over TCP/IP)	
Allow between LAN and WAN	Select this option to forward NetBIOS packets between the LAN port and the WAN port.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

Chapter 6:
Wireless Configuration

This chapter discusses how to configure the Wireless screens on the WR1500 Wireless Router.

6.1 Wireless LAN Overview

This section introduces the wireless LAN(WLAN) and some basic scenarios.

6.1.1 IBSS

An **Independent Basic Service Set (IBSS)**, also called an **Ad-hoc network**, is the simplest WLAN configuration. An IBSS is defined as two or more computers with wireless adapters within range of each other that from an independent (wireless) network without the need of an Wireless Router (AP).

Notebook with wireless adapter
Desktop with wireless adapter
Ad-hoc Wireless LAN (IBSS)
Desktop with wireless adapter
Notebook with wireless adapter

IBSS (Ad-hoc) Wireless LAN

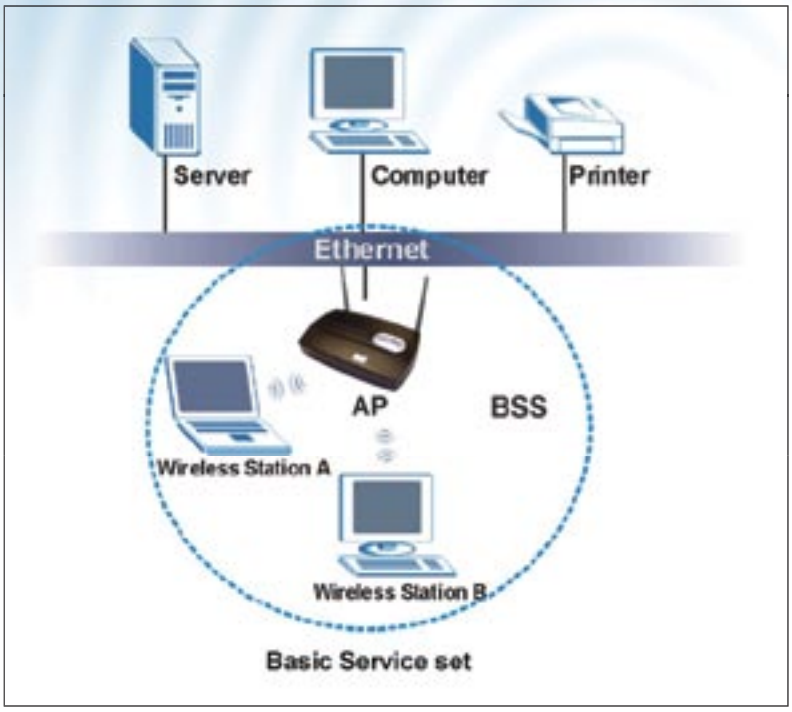
6.1.2 BSS

A **Basic Service Set (BSS)** exists when all communications between wireless stations or between a wireless station and a wired network client go through one Wireless Router (AP).

Intra-BSS traffic is traffic between wireless stations in the BSS. When Intra-BSS is enabled, wireless station A and B can access the wired network and communicate with each other. When Intra-BSS is disabled, wireless station A and B can still access the wired network but cannot communicate with each other.

The illustration on the next page describes a BSS setup.

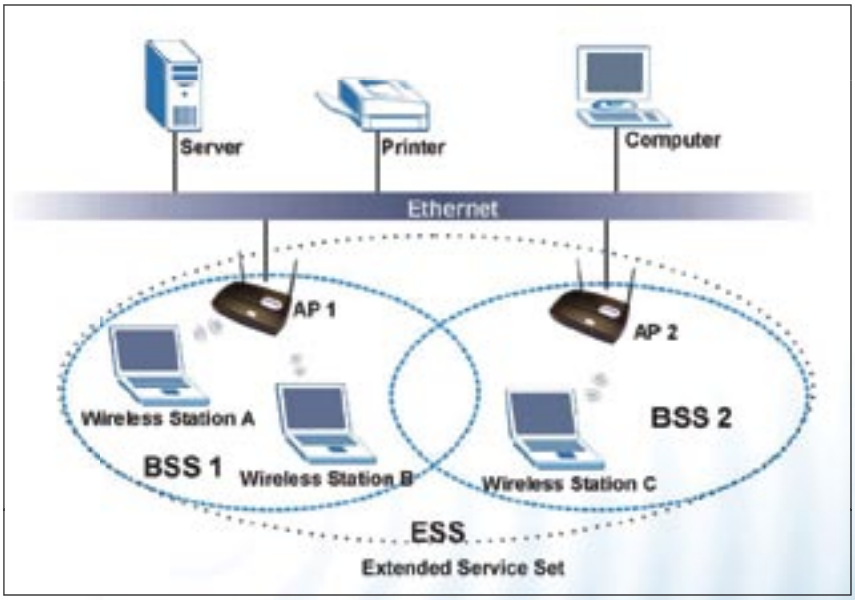
6.1.2 BSS - Continued



6.1.3 ESS

An **Extended Service Set (ESS)** consists of a series of overlapping BSSs, each containing an Wireless Router, with each Wireless Router connected together by a wired network.

This wired connection between APs is called a **Distribution System (DS)**. An **ESSID (ESS Identification)** uniquely identifies each ESS. All Wireless Routers and their associated wireless stations within the same ESS must have the same ESSID in order to communicate.

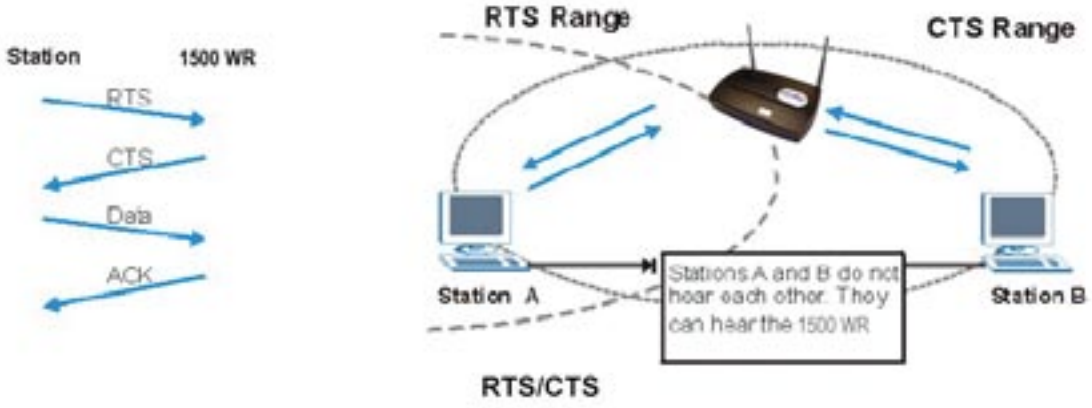


6.2 Wireless LAN Basics

6.2.1 RTS/CTS

A hidden node occurs when two stations are within range of the same Wireless Router, but are not within range of each other. The following figure illustrates a hidden node. Both stations (STA) are within range of the Wireless Router (AP) or wireless gateway, but out-of-range of each other, so they cannot “hear” each other, that is they do not know if the channel is currently being used. Therefore, they are considered hidden from each other.

When station A sends data to the WR1500 Wireless Router, it might not know that station B is already using the channel. If these two stations send data at the same time, collisions may



occur when both sets of data arrive at the AP at the same time, resulting in a loss of messages for both stations. RTS/CTS is designed to prevent collisions due to hidden nodes. An RTS/CTS defines the biggest size data frame you can send before an RTS (Request To Send)/CTS (Clear to Send) handshake is invoked.

When a data frame exceeds the RTS/CTS value you set (between 0 to 2432 bytes), the station that wants to transmit this frame must first send an RTS (Request To Send) message to the AP for permission to send it. The AP then responds with a CTS (Clear to Send) message to all other stations within its range to notify them to defer their transmission. It also reserves and confirms with the requesting station the time frame for the requested transmission.

Stations can send frames smaller than the specified RTS/CTS directly to the AP without the RTS (Request To Send)/CTS (Clear to Send) handshake.

You should only configure RTS/CTS if the possibility of hidden nodes exists on your network and the “cost” of resending large frames is more than the extra network overhead involved in the RTS (Request To Send)/CTS (Clear to Send) handshake.

If the RTS/CTS value is greater than the Fragmentation Threshold value (see next), then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach RTS/CTS size.

Enabling the RTS Threshold causes redundant network overhead that could negatively affect the throughput performance instead of providing a remedy.

6.2.2 Fragmentation Threshold

A **Fragmentation Threshold** is the maximum data fragment size (between 256 and 2432 bytes) that can be sent in the wireless network before the WR1500 Wireless Router will fragment the packet into smaller data frames.

A large Fragmentation Threshold is recommended for networks not prone to interference while you should set a smaller threshold for busy networks or networks that are prone to interference.

If the Fragmentation Threshold value is smaller than the RTS/CTS value (see previously) you set, then the RTS (Request To Send)/CTS (Clear to Send) handshake will never occur as data frames will be fragmented before they reach RTS/CTS size.

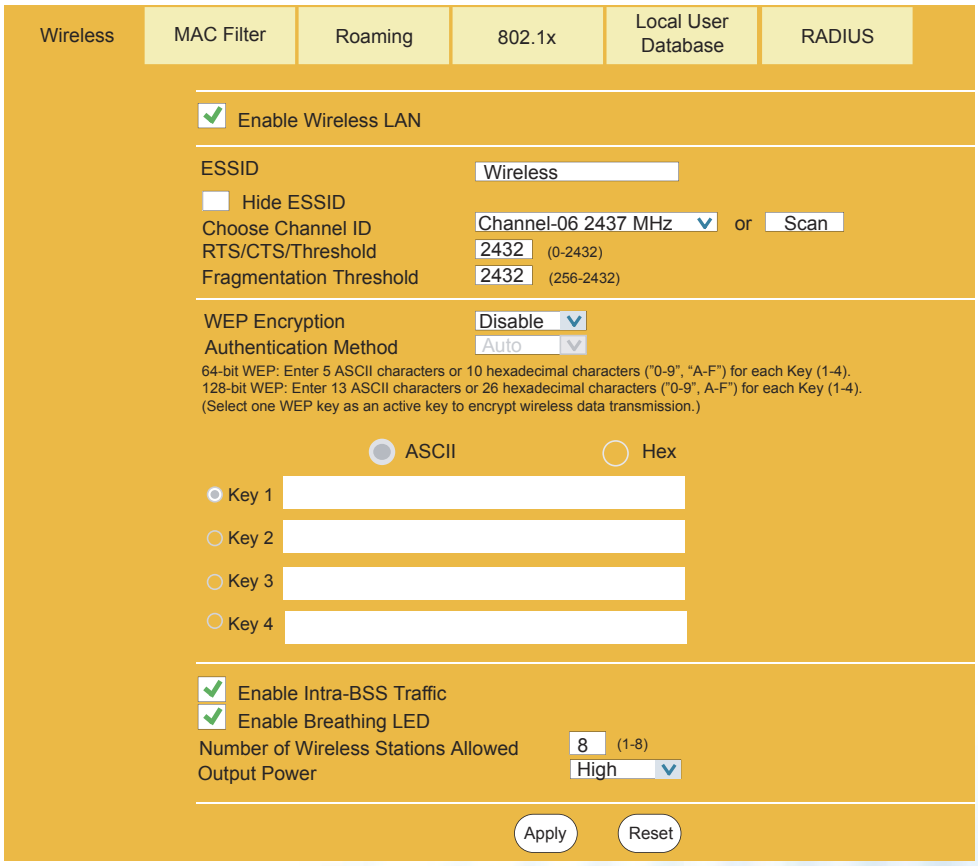
6.3 Configuring Wireless

If you are configuring the WR1500 Wireless Router from a computer connected to the wireless LAN and you change the WR1500 Wireless Router's ESSID or WEP settings, you will lose your wireless connection when you press Apply to confirm.

You must then change the wireless settings of your computer to match the WR1500 Wireless Router's new settings.

Click **ADVANCED** and then **WIRELESS** to open the Wireless screen.

WIRELESS LAN



The table on the next page describes the options in this screen.

6.3 Configuring Wireless - Continued

The following table describes the options on the screen shown on the previous page.

LABEL	DESCRIPTION
Enable Wireless LAN	Click the check box to activate wireless LAN.
ESSID	(Extended Service Set IDentity) The ESSID identifies the Service Set with which a wireless station is associated. Wireless stations associating to the Wireless Router (AP) must have the same ESSID. Enter a descriptive name (up to 32 printable 7-bit ASCII characters) for the wireless LAN.
	If you are configuring the WR1500 Wireless Router from a computer connected to the wireless LAN and you change the WR1500 Wireless Router's ESSID or WEP settings, you will lose your wireless connection when you press Apply to confirm. You must then change the wireless settings of your computer to match the WR1500 Wireless Router's new settings.
Hide ESSID	Select this check box to hide the ESSID in the outgoing beacon frame so a station cannot obtain the ESSID through passive scanning using a site survey tool.
Choose Channel ID	Set the operating frequency/channel depending on your particular region. To manually set the WR1500 Wireless Router to use a channel, select a channel from the drop-down list box. Click **MAINTENANCE, WIRELESS** and then the **Channel Usage** tab to open the **Channel Usage** screen to make sure the channel is not already used by another AP or independent peer-to-peer wireless network. To have the WR1500 Wireless Router automatically select a channel, click **Scan** instead. Refer to the *Wizard Setup* chapter for more information on channels.
Scan	Click this button to have the WR1500 Wireless Router automatically scan for and select a channel with the least interference.
RTS/CTS Threshold	Enter a value between 0 and 2432. The default is **2432.**
Fragmentation Threshold	Enter a value between 256 and 2432. The default is **2432.** It is the maximum data fragment size that can be sent.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

See the *Wireless Security* chapter for information on the other labels in this screen.

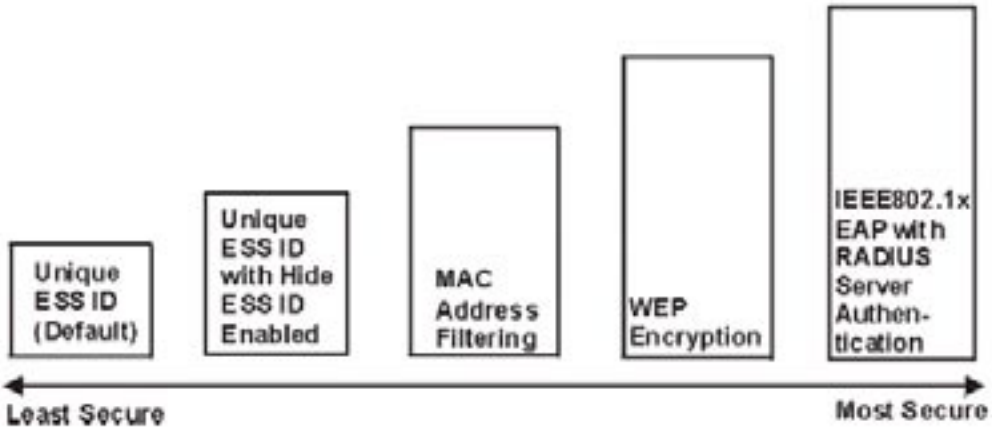
Chapter 7: Wireless Security

This Chapter describes how to use the MAC Filter, 802. Ix, Local User Database and RADIUS to configure wireless security on your WR1500 Wireless Router.

7.1 Wireless Security Overview

Wireless security is vital to your network to protect wireless communication between wireless stations, Wireless Routers and the wired network.

The figure below shows the possible wireless security levels on your WR1500 Wireless Router. The highest security level relies on EAP (Extensible Authentication Protocol) for authentication and utilizes dynamic WEP key exchange. It requires interaction with a RADIUS (Remote Authentication Dial-In User Service) server either on the WAN or your LAN to provide authentication service for wireless stations.



Wireless Security Levels

IMPORTANT - If you do not enable any wireless security on your WR1500 Wireless Router, your network is accessible to any wireless networking device that is within range.

7.2 WEP Overview

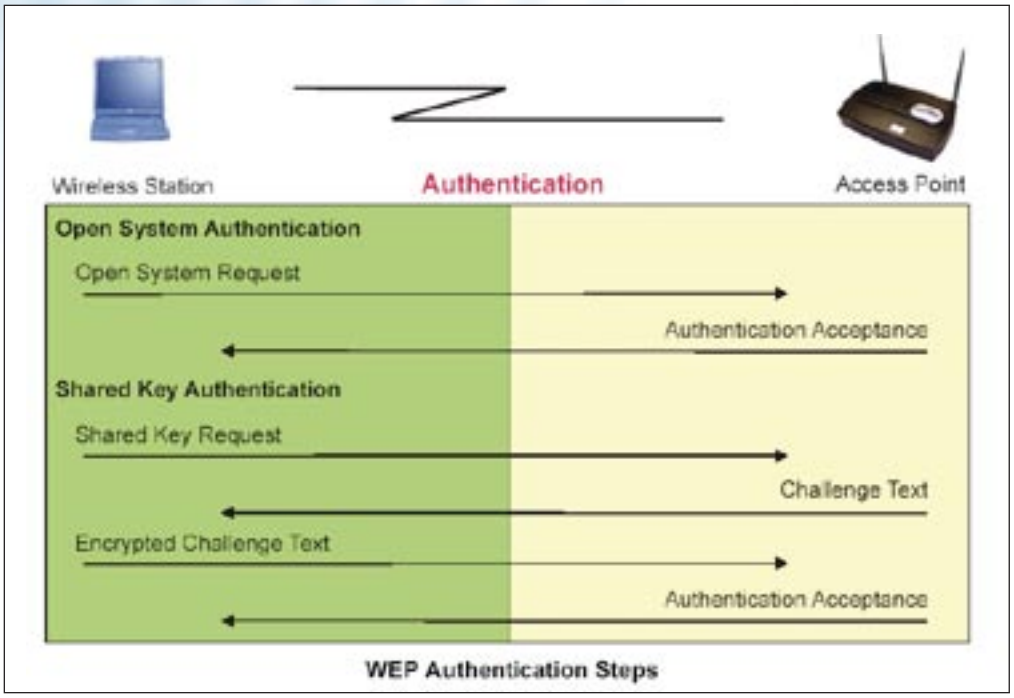
WEP (Wired Equivalent Privacy) as specified in the IEEE 802.11 standard provides methods for both data encryption and wireless station authentication.

7.2.1 Data Encryption

WEP provides a mechanism for encrypting data using encryption keys. Both the AP and the wireless stations must use the same WEP key to encrypt and decrypt data. Your WR1500 Wireless Router allows you to configure up to four 64-bit or 128-bit WEP keys, but only one key can be enabled at any one time.

7.2.2 Authentication

Three different methods can be used to authenticate wireless stations to the network: **Open System**, **Shared Key**, and **Auto**. The following figure illustrates the steps involved.



WEP Authentication Steps

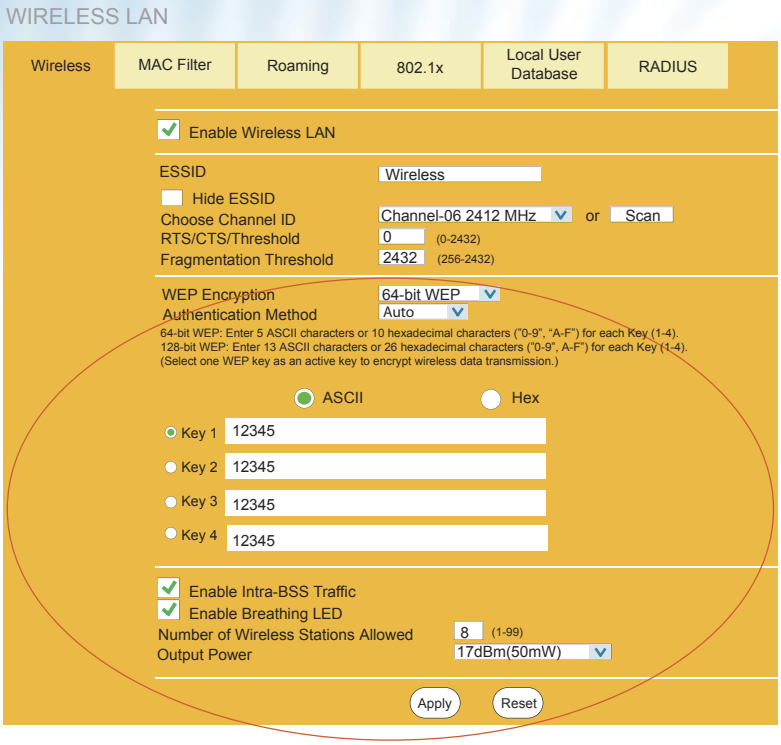
Open system authentication involves an unencrypted two-message procedure. A wireless station sends an open system authentication request to the AP, which will then automatically accept and connect the wireless station to the network. In effect, open system is not authentication at all as any station can gain access to the network.

Shared key authentication involves a four-message procedure. A wireless station sends a shared key authentication request to the AP, which will then reply with a challenge text message. The wireless station must then use the AP's default WEP key to encrypt the challenge text and return it to the AP, which attempts to decrypt the message using the AP's default WEP key. If the decrypted message matches the challenge text, the wireless station is authenticated.

When your WR1500 Wireless Router's authentication method is set to open system, it will only accept open system authentication requests. The same is true for shared key authentication. However, when it is set to **auto authentication**, the WR1500 Wireless Router will accept either type of authentication request and the WR1500 Wireless Router will fall back to use open authentication if the shared key does not match.

7.3 Configuring WEP Encryption

In order to configure and enable WEP encryption; click **ADVANCED** and then **WIRELESS** to display the Wireless screen.



The following table describes the wireless LAN security labels in this screen.

LABEL	DESCRIPTION
WEP Encryption	Select **Disable** to allow wireless stations to communicate with the Wireless Routers without any data encryption. Select **64-bit WEP** or **128-bit WEP** to enable data encryption.
Authentication Method	This field is activated when you select **64-bit WEP** or **128-bit WEP** in the **WEP Encryption** field. Select **Auto, Open System** or **Shared Key** from the drop-down list box.
ASCII	Select this option in order to enter ASCII characters as the WEP keys.
Hex	Select this option in order to enter hexadecimal characters as the WEP keys. The preceding "Ox", that identifies a hexadecimal key, is entered automatically.
Key 1 to Key 4	The WEP keys are used to encrypt data. Both the WR1500 Wireless Router and the wireless stations must use the same WEP key for data transmission. If you chose **64-bit WEP,** then enter any 5 ASCII characters or 10 hexadecimal characters ("0-9", "A-F"). If you chose **128-bit WEP,** then enter 13 ASCII characters or 26 hexadecimal characters ("0-9", "A-F"). You must configure all four keys, but only one key can be activated at any one time. The default key is key 1.

Continued on next page

7.3 Configuring WEP Encryption - Continued

Table continued from preceding page.

LABEL	DESCRIPTION
Enable Intra-BSS Traffic	Intra-BSS traffic is traffic between wireless stations in the BSS. Select this check box to enable Intra-BSS Traffic.
Enable Breathing LED	Select this check box to enable the Breathing LED, also known as the WR1500 Wireless Router LED. The blue WR1500 Wireless Router LED is on when the WR1500 Wireless Router is on and blinks (or breaths) when data is being transmitted to/from its wireless stations. Clear the check box to turn this LED off even when the WR1500 Wireless Router is on and data is being transmitted/received.
Number of Wireless Stations Allowed	Use this field to set a maximum number of wireless stations that may connect to the WR1500 Wireless Router. Enter the number (from 1 to 8) of wireless stations allowed.
Output Power	Set the output power of the WR1500 Wireless Router in this field. If there is a high density of APs within an area, decrease the output power of the WR1500 Wireless Router to reduce interference with other APs. The options are **11dBm (50mW), 13dBm (32mW), 15dBm (20mW)** or **17dBm (12.6mW).**
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset to** reload the previous configuration for this screen.

7.4 MAC Filter

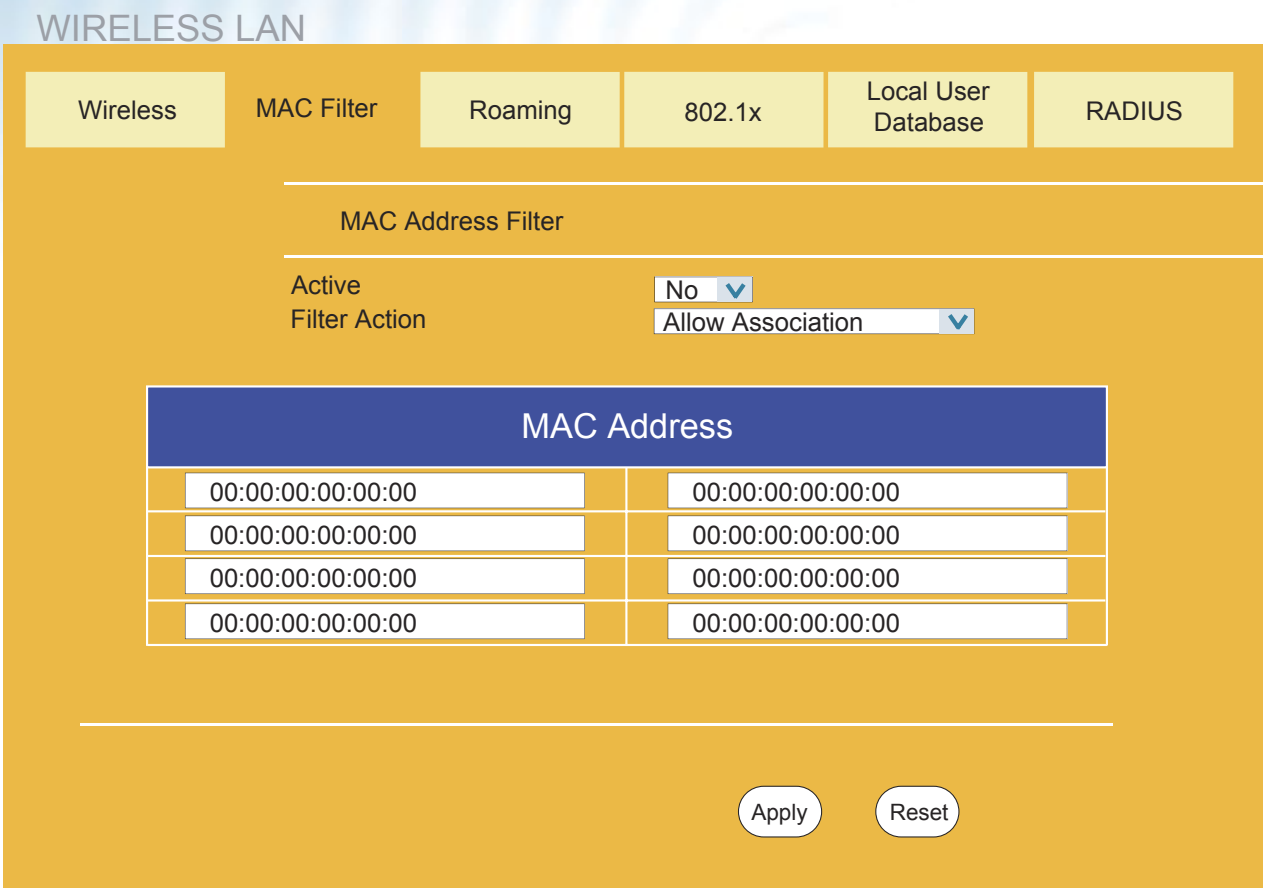
The MAC filter screen allows you to configure the WR1500 Wireless Router to give exclusive access to up to 8 devices (Allow Association) or exclude up to 8 devices from accessing the WR1500 Wireless Router (Deny Association). Every Ethernet device has a unique MAC (Media Access Control) address. The MAC address is assigned at the factory and consists of six pairs of hexadecimal characters, for example, 00:A0:C5:00:00:02. You need to know the MAC address of the devices to configure this screen.

To change your WR1500 Wireless Router's MAC filter settings, click **ADVANCED**, **WIRELESS** and then the **MAC Filter** tab.

The screen appears as shown on the next page.

7.4 MAC Filter - Continued

MAC Filter Configuration Screen:



The following table describes the labels in this menu.

LABEL	DESCRIPTION
Active	Select **Yes** from the drop down list box to enable MAC address filtering.
Filter Action	Define the filter action for the list of MAC addresses in the **MAC Address** table. Select **Deny Association** to block access to the WR1500 Wireless Router, MAC addresses not listed will be allowed to access the WR1500 Wireless Router. Select **Allow Association** to permit access to the WR1500 Wireless Router, MAC addresses not listed will be denied access to the WR1500 Wireless Router.
MAC Address	Enter the MAC addresses (in XX:XX:XX:XX:XX:XX format) of the wireless station that are allowed or denied access to the WR1500 Wireless Router in these address fields.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

7.5 802.1 x Overview

The IEEE 802. lx standard outlines enhanced security methods for both the authentication of wireless stations and encryption key management. Authentication can be done using the local user database internal to the WR1500 Wireless Router (authenticate up to 8 users) or an external RADIUS server for an unlimited number of users.

7.6 Introduction to RADIUS

RADIUS is based on a client-sever model that supports authentication and accounting, where Wireless Router is the client and the server is the RADIUS server. The RADIUS server handles the following tasks among others:

- **Authentication** - Determines the identity of the users.
- **Accounting** - Keeps track of the client's network activity.

RADIUS user is a simple package exchange in which your WR1500 Wireless Router acts as a message relay between the wireless station and the network RADIUS server.

Types of RADIUS Messages

The following types of RADIUS messages are exchanged between the Wireless Router and the RADIUS server for user authentication:

- **Access-Request** - Sent by an Wireless Router requesting authentication.
- **Access-Reject** - Sent by a RADIUS server rejecting access.
- **Access-Accept** - Sent by a RADIUS server allowing access.
- **Access-Challenge** - Sent by a RADIUS server requesting more information in order to allow access.The Wireless Router sends a proper response from the user and then sends another Access-Request message.

The following types of RADIUS messages are exchanged between the Wireless Router and the RADIUS server for user accounting:

- **Accounting-Request** - Sent by the Wireless Router requesting accounting.
- **Accounting-Response** - Sent by the RADIUS server to indicate that it has started or stopped accounting.

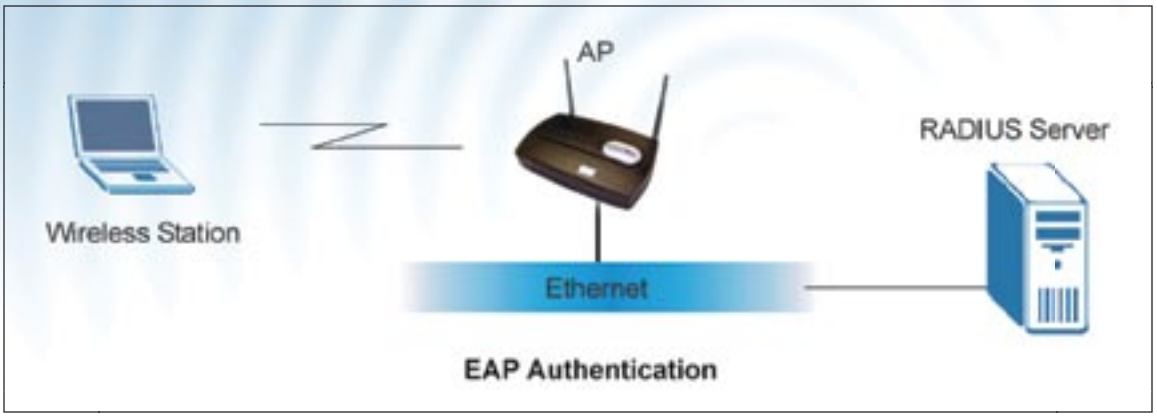
In order to ensure network security, the Wireless Router and the RADIUS server use a shared secret key, which is a password, they both know. The key is not sent over the network. In addition to the shared key, password information exchanged is also encrypted to protect the wired network from unauthorized access.

7.6.1 EAP Authentication Overview

EAP (Extensible Authentication Protocol) is an authentication protocol that runs on top of the IEEE802.1x transport mechanism in order to support multiple types of user authentication. By using EAP to interact with an EAP-compatible RADIUS server, the Wireless Router helps a wireless station and a RADIUS server perform authentication.

Continued on next page

7.6.1 EAP Authentication Overview - Continued



The type of authentication you use depends on the RADIUS server or the AP. The WR1500 Wireless Router supports EAP-TLS, EAP-TTLS and DEAP with RADIUS. Refer to the Types of EAP Authentication appendix for descriptions on the four common types.

Your WR1500 Wireless Router supports EAP-MD5 (Message-Digest Algorithm 5) with the local user database and RADIUS. The following figure shows an overview of authentication when you specify a RADIUS server on your Wireless Router.

The details below provide a general description of how IEEE 802. lx EAP authentication works. For an example list of EAP-MD5 authentication steps, see the IEEE 802.lx appendix.

- The wireless station sends a “start” message to the WR1500 Wireless Router.
- The WR1500 Wireless Router sends a “request identity” message to the wireless station for identity information.
- The wireless station replies with identity information, including username and password.
- The RADIUS server checks the user information against its user profile database and determines whether or not to authenticate the wireless station.

7.7 Dynamic WEP Key Exchange

The AP maps a unique key that is generated with the RADIUS server. This key expires when the wireless connection times out, disconnects or reauthentication times out. A new WEP key is generated each time reauthentication is performed.

If this feature is enabled, it is not necessary to configure a default encryption key in the Wireless screen. You may still configure and store keys here, but they will not be used while Dynamic WEP is enabled.

To use Dynamic WEP, enable and configure the RADIUS server (see section 7.11) and enable Dynamic WEP Key Exchange in the 802.lx screen. Ensure that the wireless station’s EAP type is configured to one of the following:

- **EAP-TLS**
- **EAP-TTLS**
- **PEAP**

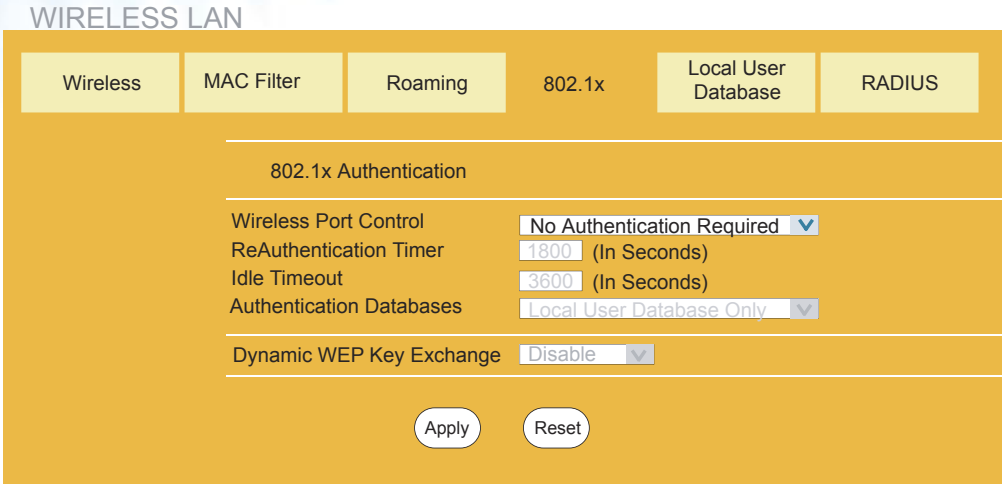
EAP-MD5 cannot be used with Dynamic WEP Key Exchange.

7.8 Introduction to Local User Database

By storing user profiles locally on the WR1500 Wireless Router, your WR1500 Wireless Router is able to authenticate wireless users without interacting with a network RADIUS server. However, there is a limit on the number of users you may authenticate in this way.

7.9 Configuring 802.1 x

To change your WR1500 Wireless Router's authentication settings, click **ADVANCED, WIRELESS** and then the **802.1x tab**. The screen appears as shown below.



The following table describes the settings on this screen.

LABEL	DESCRIPTION
Wireless Port Control	To control wireless stations access to the wired network, select a control method from the drop-down list box. Choose from **No Authentication Required, Authentication Required** and **No Access Allowed.** **No Authentication Required** allows all wireless stations access to the wired network without entering usernames and passwords. This is the default setting. **Authentication Required** means that all wireless stations have to enter usernames and passwords before access to the wired network is allowed. **No Access Allowed** blocks all wireless stations access to the wired network.
ReAuthentication Timer (in seconds)	Specify how often wireless stations have to reenter usernames and passwords in order to stay connected. This field is activated only when you select **Authentication Required** in the **Wireless Port Control** field. Enter a time interval between 10 and 9999 seconds. The default time interval is **1800** seconds (30 minutes). **If wireless station authentication is done using a RADIUS server, the reauthentication timer on the RADIUS server has priority.**
Idle Timeout	The WR1500 Wireless Router automatically disconnects a wireless station from the wired network after a period of inactivity. The wireless station needs to enter the username and password again before access to the wired network is allowed. This field is activated only when you select **Authentication Required** in the **Wireless Port Control** field. The default time interval is **3600** seconds (or 1 hour).

Table continued on next page

7.9 Configuring 802.1 x - Continued

LABEL	DESCRIPTION
Authentication Databases	This field is activated only when you select **Authentication Required** in the **Wireless Port Control** field. The authentication database contains wireless station login information. The local user database is the built-in database on the WR1500 Wireless Router. The RADIUS is an external server. Use this drop-down list box to select which database the WR1500 Wireless Router should use (first) to authenticate a wireless station. Before you specify the priority, make sure you have set up the corresponding database correctly first. Select **Local User Database Only** to have the WR1500 Wireless Router just check the built-in user database on the WR1500 Wireless Router for a wireless station's username and password. Select **RADIUS Only** to have the WR1500 Wireless Router just check the user database on the specified RADIUS server for a wireless station's username and password. Select **Local first, then RADIUS** to have the WR1500 Wireless Router first check the user database on the WR1500 Wireless Router for a wireless station's username and password. If the user name is not found, the WR1500 Wireless Router then checks the user database on the specified RADIUS server. Select **RADIUS first, then Local** to have the WR1500 Wireless Router first check the user database on the specified RADIUS server for a wireless station's username and password. If the WR1500 Wireless Router cannot reach the RADIUS server, the WR1500 Wireless Router then checks the local user database on the WR1500 Wireless Router. When the user name is not found or password does not match in the RADIUS server, the WR1500 Wireless Router will not check the local user database and the authentication fails.
Dynamic WEP Key Exchange	This field is activated only when you select **Authentication Required** in the **Wireless Port Control** field. Also set the **Authentication Databases** field to **RADIUS Only.** Local user database may not be used. Select **Disable** to allow wireless stations to communicate with the Wireless Routers without using dynamic WEP key exchange. Select **64-bit WEP** or **128-bit WEP** to enable data encryption. Up to 8 stations can access the WR1500 Wireless Router when you configure dynamic WEP key exchange.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

Once you enable user authentication, you need to specify an external RADIUS server or create local user accounts on the WR1500 Wireless Router for authentication.

7.10 Configuring Local User Database

To change your WR1500 Wireless Router's local user database, click **ADVANCED, WIRELESS** and then the **Local User Database tab**. The screen appears as shown (some of the screen's blank rows are not shown).

The descriptions for the settings in this screen are described on the next page.

7.10 Configuring Local User Database - Continued

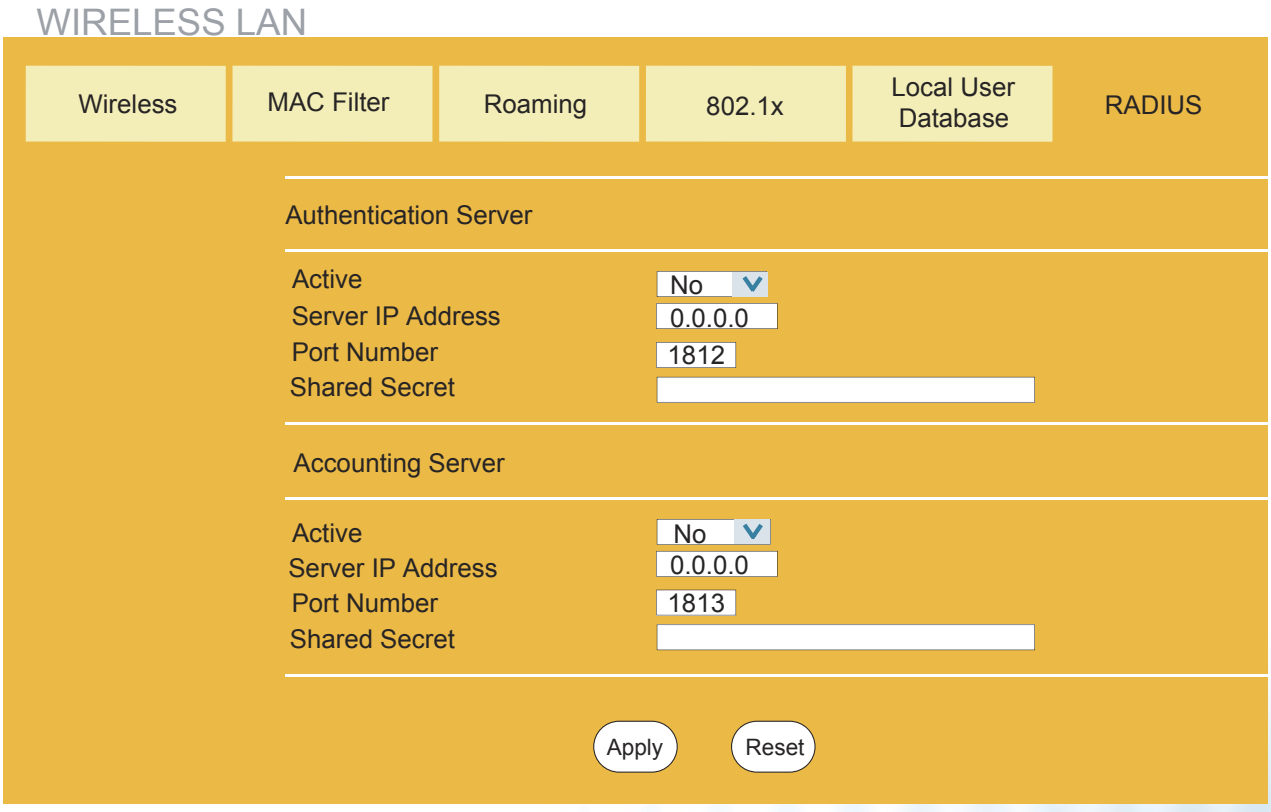
The following table describes the labels in the screen shown on the preceding page.

LABEL	DESCRIPTION
Active	Select this option to activate the user profile.
User Name	Enter the username (up to 31 characters) for this user profile.
Password	Type a password (up to 31 characters) for this user profile. Note that as you type a password, the screen displays a (*) for each character you type.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

7.11 Configuring RADIUS

Use **RADIUS** if you want to authenticate wireless users using an external server.

To specify a RADIUS server, click **ADVANCED, WIRELESS** and then the **RADIUS tab**. The screen appears as shown below.



The descriptions for the labels in the screen above are shown on the next page.

7.11 Configuring RADIUS - Continued

The following table describes the labels in this screen on the preceding page.

LABEL	DESCRIPTION
Authentication Server	
Active	Select **Yes** from the drop down list box to enable user authentication through an external authentication server.
Server IP Address	Enter the IP address of the external authentication server in dotted decimal notation.
Port Number	Enter the port number of the external authentication server. The default port number is **1812.** You need not change this value unless your network administrator instructs you to do so with additional information.
Shared Secret	Enter a password (up to 31 alphanumeric characters) as the key to be shared between the external authentication server and the WR1500 Wireless Router. The key must be the same on the external authentication server and your WR1500 Wireless Router. The key is not sent over the network.
Accounting Server	
Active	Select **Yes** from the drop down list box to enable user accounting through an external authentication server.
Server IP Address	Enter the IP address of the external accounting server in dotted decimal notation.
Port Number	Enter the port number of the external accounting server. The default port number is **1813.** You need not change this value unless your network administrator instructs you to do so with additional information.
Shared Secret	Enter a password (up to 31 alphanumeric characters) as the key to be shared between the external accounting server and the WR1500 Wireless Router. The key must be the same on the external accounting server and your WR1500 Wireless Router. The key is not sent over the network.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to reload the previous configuration for this screen.

Part III

WAN's - Wide Area Networks

This part discusses Wide Area Network (WAN) Setup Screens.

Chapter 8:
WAN Configuration Screens

This chapter describes how to configure the WR1500 Wireless Router WAN screens.

8.1 WAN Overview

A WAN (Wide Area Network) is an outside connection to another network or the Internet.

See the Wizard Setup chapter for more background information on most fields in the WAN screens.

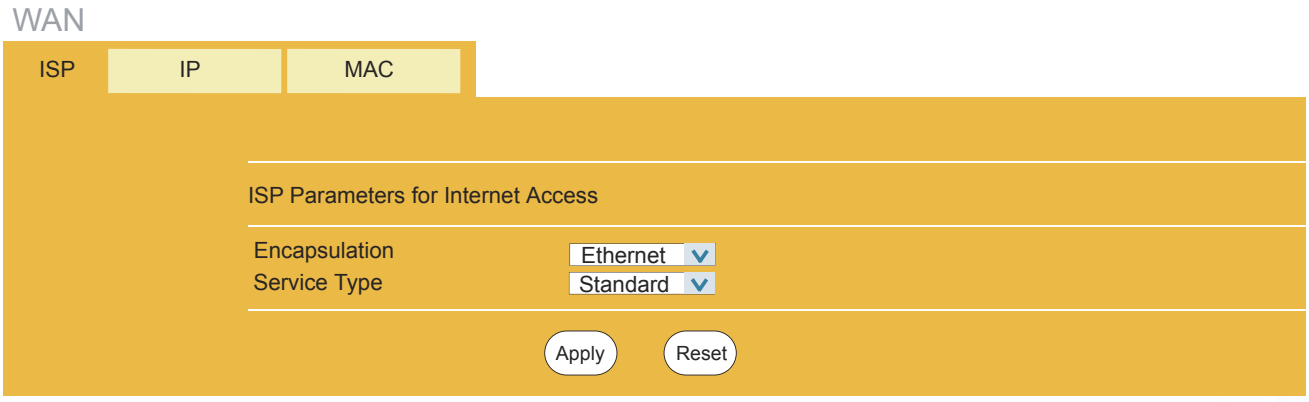
Background information on WAN fields not included in the Wizard is described here.

8.2 Configuring WAN ISP

To change your WR1500 Wireless Router's WAN ISP settings, click ADVANCED, WAN and then the ISP tab. The screen differs by the encapsulation.

8.2.1 Ethernet Encapsulation

The screen shown next is for Ethernet encapsulation.



The descriptions for the labels in the screen above are shown on the next page.

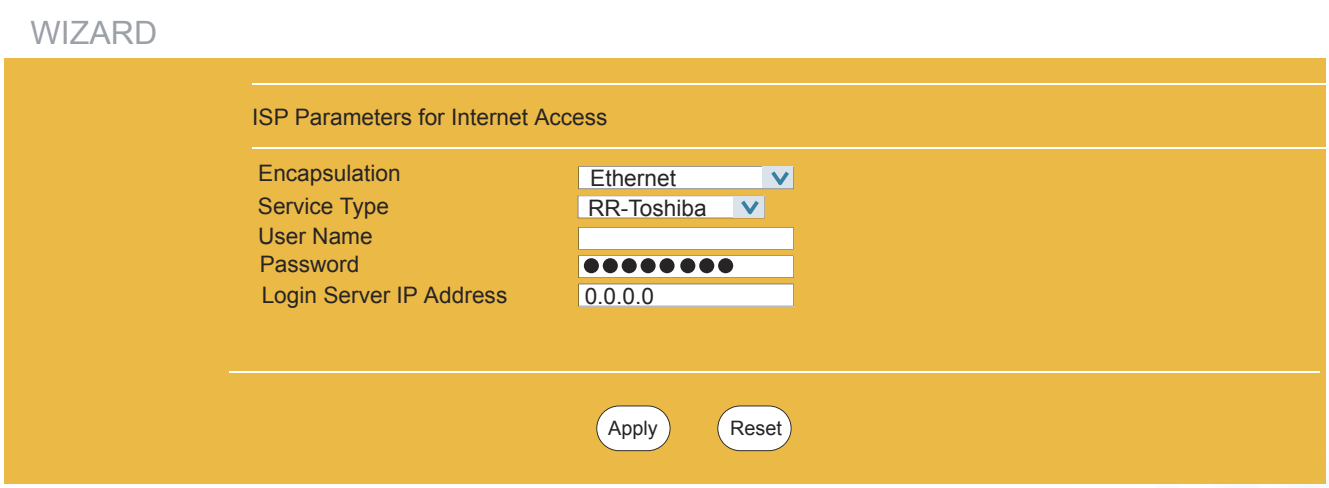
8.2.1 Ethernet Encapsulation - Continued

The following table describes the labels on the screen on the preceding page.

Ethernet Encapsulation	
LABEL	**DESCRIPTION**
Encapsulation	You must choose the Ethernet option when the WAN port is used as a regular Ethernet.
Service Type	Select from **Standard, RR-Toshiba** (RoadRunner Toshiba authentication method), **RR-Manager** (Roadrunner Manager authentication method), **RR-Telstra** or **Telia Login.** Choose a Roadrunner service type if your ISP is Time Warner's Roadrunner; otherwise choose **Standard.**
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

Service Type

The screen varies according to the service type you select. You need a username and password if your ISP is Time Warner's Roadrunner.



The descriptions for the labels in the screen above are shown on the next page.

8.2.1 Ethernet Encapsulation Service Type - Continued

The following table describes the labels on the screen on the preceding page.

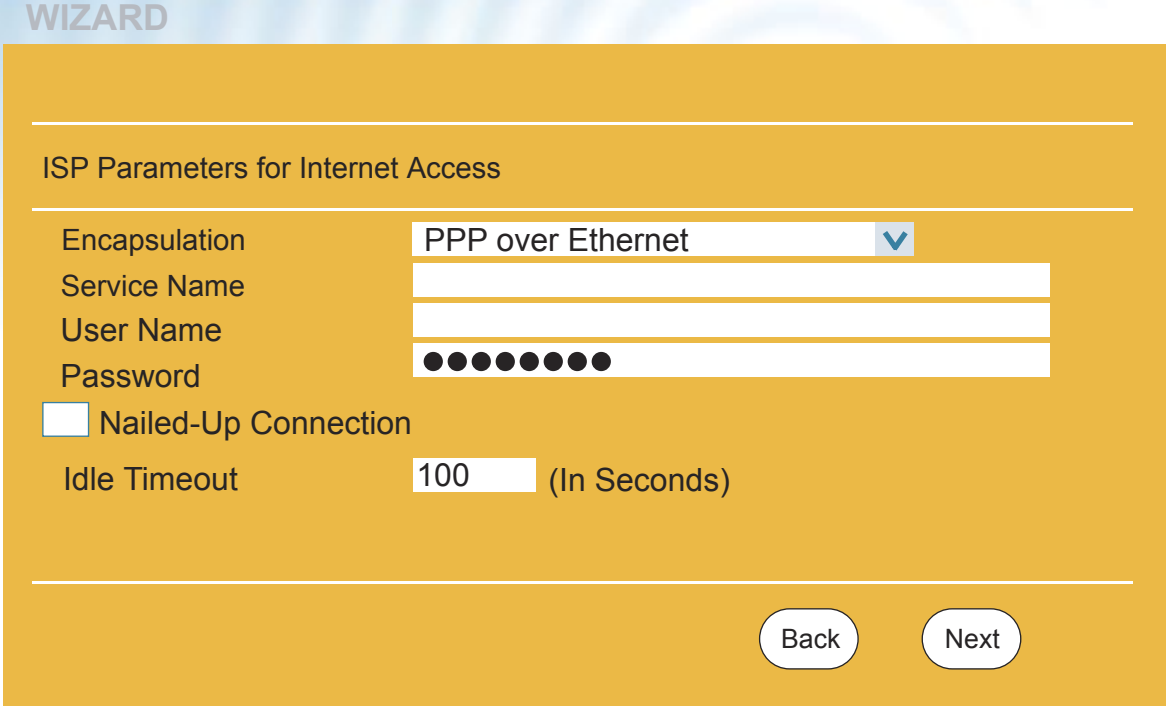
LABEL	DESCRIPTION
Encapsulation	You must choose the Ethernet option when the WAN port is used as a regular Ethernet.
Service Type	Select from **Standard, RR-Toshiba** (RoadRunner Toshiba authentication method), **RR-Manager** (Roadrunner Manager authentication method) **RR-Telstra** or **Telia Login.** Choose a Roadrunner service type if your ISP is Time Warner's Roadrunner; otherwise choose **Standard.**
User Name	Enter the username given to you by your ISP.
Password	Enter the password associated with the login name above.
Retype to Confirm	Type your password again here to ensure that what you entered in the **Password** field above was what you intended.
Login Server IP Address	The WR1500 Wireless Router will find the Roadrunner Server IP address if this field is left blank. If it does not, then you must enter the authentication server IP address.
Login Server (Telia Login only)	Type the domain name of the Telia login server, for example "login1 .telia.com". This field is not available on all models.
Relogin Every(min) (Telia Login only)	The Telia server logs the WR1500 Wireless Router out if the WR1500 Wireless Router does not log in periodically. Type the number of minutes from 1 to 59 (30 recommended) for the WR1500 Wireless Router to wait between logins. This field is not available on all models.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

8.2.2 PPPoE Encapsulation

PPPoE (Point-to-Point Protocol over Ethernet) is an IETF Draft standard (RFC 2516) specifying how a personal computer (PC) interacts with a broadband modem (DSL, cable, wireless, etc.) connection. The PPP over Ethernet option is for a dial-up connection using PPPoE.

The screen shown on the next page is for **PPP over Ethernet** encapsulation.

8.2.2 PPPoE Encapsulation - Continued



The following table describes the labels in this screen.

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	The **PPP over Ethernet** choice is for a dial-up connection using PPPoE. The WR1500 Wireless Router supports PPPoE (Point-to-Point Protocol over Ethernet).
Service Name	Type the PPPoE service name provided to you. PPPoE uses a service name to identify and reach the PPPoE server.
User Name	Type the username given to you by your ISP.
Password	Type the password associated with the user name above.
Retype to Confirm	Type your password again here to ensure that what you entered in the **Password** field above was what you intended.
Nailed Up Connection	Select **Nailed Up Connection** if you do not want the connection to time out.
Idle Timeout	Specify the time in seconds that elapses before the WR1500 Wireless Router automatically disconnects from the PPPoE server.

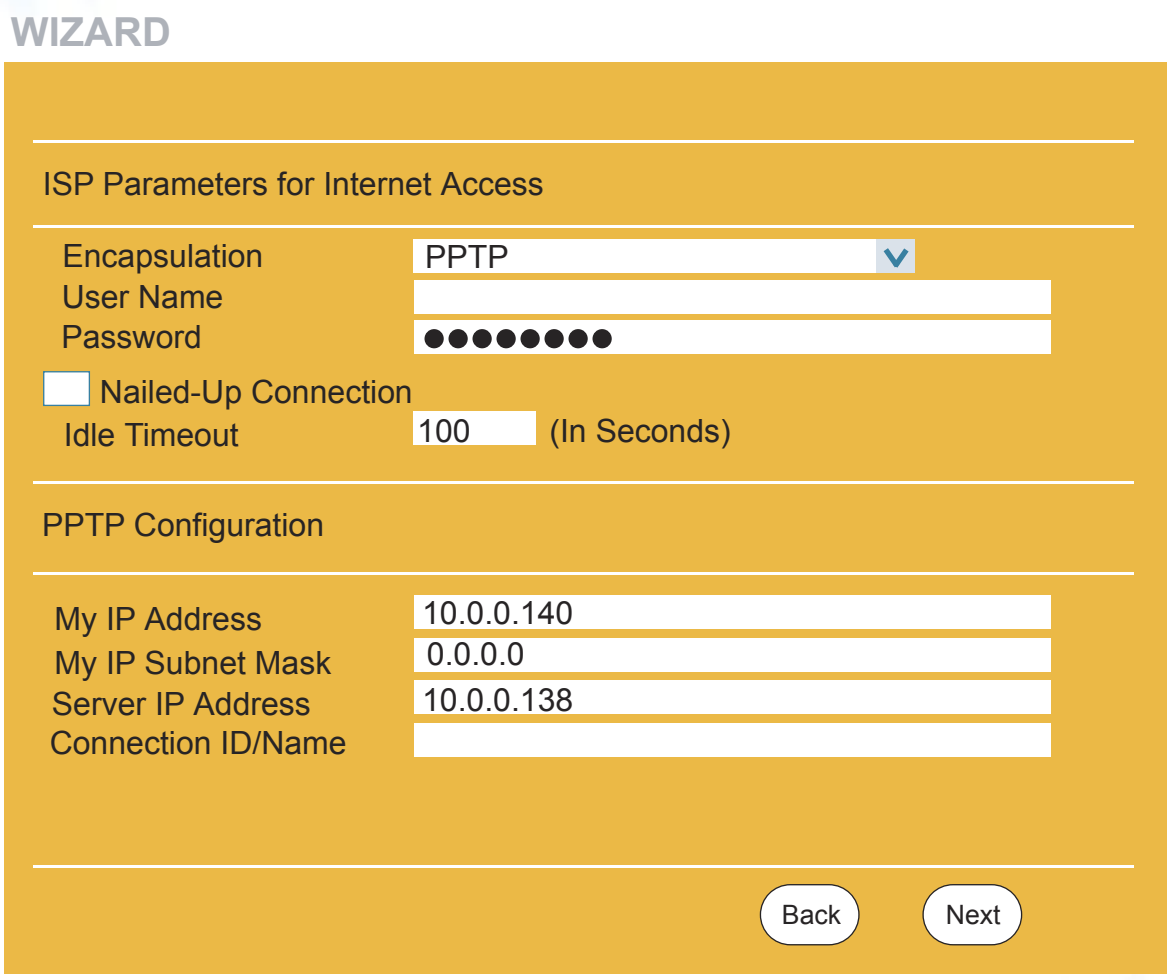
Apply	**Click Apply to save your changes back to the WR1500 Wireless Router.**
Reset	**Click Reset to begin configuring this screen afresh.**

8.2.3 PPTP Encapsulation

Point-to-Point Tunneling Protocol (PPTP) is a network protocol that enables secure transfer of data from a remote client to a private server, creating a Virtual Private Network (VPN) using TCP/IP-based networks.

PPTP supports on-demand, multi-protocol and virtual private networking over public networks, such as the Internet.

The screen shown below is for PPTP encapsulation.



The descriptions for the labels in the screen above are shown on the next page.

8.2.3 PPTP Encapsulation - Continued

The following table describes the labels on the screen on the preceding page.

LABEL	DESCRIPTION
ISP Parameters for Internet Access	
Encapsulation	PPTP supports on-demand, multi-protocol, and virtual private networking over public networks, such as the Internet. The WR1500 Wireless Router supports only one PPTP server connection at any given time. To configure a PPTP client, you must configure the My Login and Password fields for a PPP connection and the PPTP parameters for a PPTP connection.
User Name	Type the user name given to you by your ISP.
Password	Type the password associated with the user name above.
Retype to Confirm	Type your password again here to ensure that what you entered in the **Password** field above was what you intended.
Nailed-up Connection	Select **Nailed Up Connection** if you do not want the connection to time out.
Idle Timeout	Specify the time in seconds that elapses before the WR1500 Wireless Router automatically disconnects from the PPTP server.
PPTP Configuration	
My IP Address	Type the (static) IP address assigned to you by your ISP.
My IP Subnet Mask	Type the subnet mask assigned to you by your ISP (if given).
Server IP Address	Type the IP address of the PPTP server.
Connection ID/Name	Type your identification name for the PPTP server.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

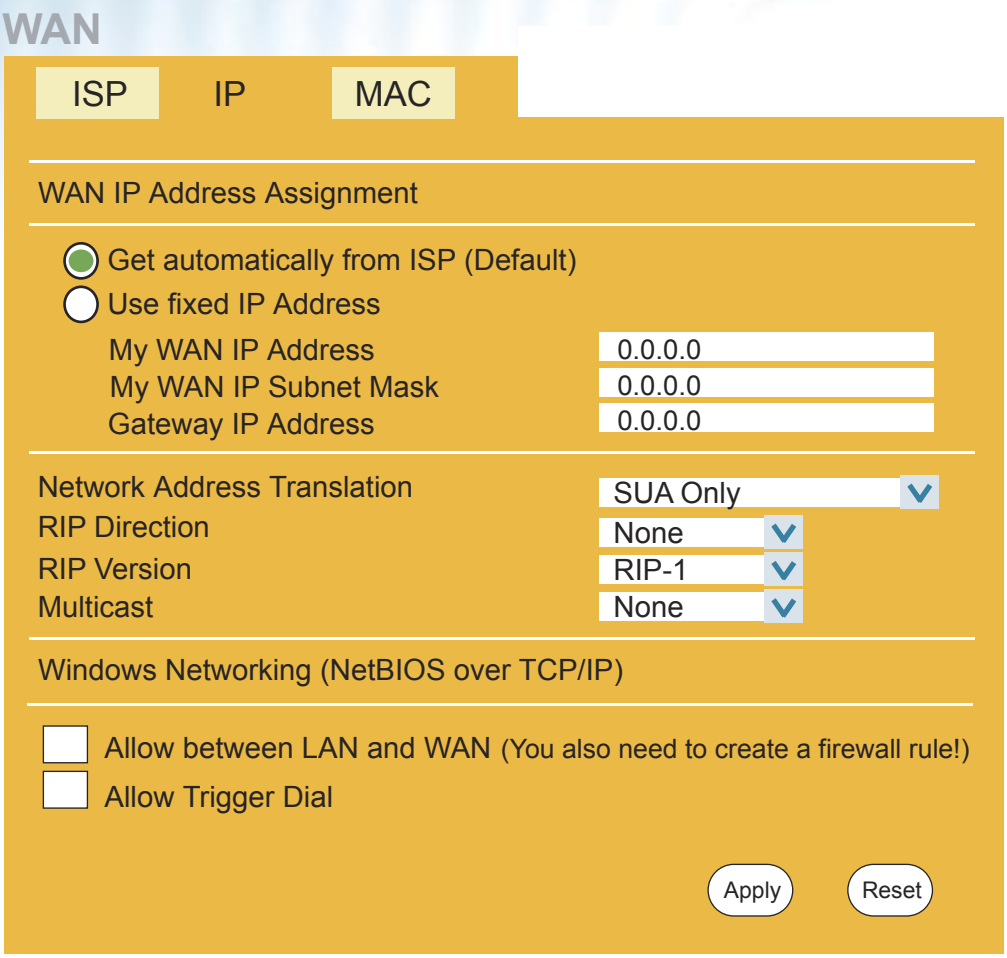
8.3 TCP/IP Priority (Metric)

The metric represents the “cost of transmission”. A router determines the best route for transmission by choosing a path with the lowest “cost”. RIP routing uses hop count as the measurement of cost, with a minimum of “ 1” for directly connected networks. The number must be between “ 1” and “ 15”; a number greater than “15” means the link is down. The smaller the number, the lower the “cost”.

The metric sets the priority for the WR1500 Wireless Router’s routes to the Internet, if any two of the default routes have the same metric.

8.4 Configuring WAN IP

To change your WR1500 Wireless Router's WAN IP settings, click **ADVANCED, WAN** and then the **IP** tab.



The table on the following page describes the labels in this screen.

8.4 Configuring WAN IP - Continued

The following table describes the labels on the screen on the preceding page.

LABEL	DESCRIPTION
WAN IP Address Assignment	
Get automatically from ISP option	Select this selection if your ISP did not assign you a fixed IP address. This is the default
Use fixed IP address	Select this option If the ISP assigned a fixed IP address.
My WAN IP Address	Enter the WR1500 Wireless Router WAN IP address in this field if you selected **Use Fixed IP Address.**
My WAN IP Subnet Mask (Ethernet encapsulation)	Enter the WR1500 Wireless Router WAN IP subnet mask (if your ISP gave you one) in this field if you selected **Use Fixed IP Address.**
Remote IP Address (or Gateway IP Address)	Type the IP address of the remote network or gateway. The gateway is an immediate neighbor of your WR1500 Wireless Router that will forward the packet to the destination. On the LAN, the gateway must be a router on the same segment as your WR1500 Wireless Router; over the WAN, the gateway must be the IP address of one of the remote nodes.
Remote IP Subnet Mask (PPPoE and PPTP encapsulation)	When using a LAN to LAN application, type the IP subnet mask of the destination network. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255, in the subnet mask field, to force the network number to be identical to the host ID.
Network Address Translation	Network Address Translation (NAT) allows the translation of an Internet protocol address used within one network to a different IP address known within another network. **SUA** (Single User Account) is a subset of NAT that supports two types of mapping: **Many-to-One** and **Server.** When you select this option the WR1500 Wireless Router will use Address Mapping Set 255 in the SMT. Choose **SUA Only** if you have just one public WAN IP address for your WR1500 Wireless Router. Choose **Full Feature** if you have multiple public WAN IP addresses for your WR1500 Wireless Router. For more information about NAT refer to the MAT chapter in this *User's Guide.*
Metric (PPPoE and PPTP only)	Type a number that approximates the cost for this link. Metric represents the "cost" of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. The number need not be precise, but it must be between 1 and 15. In practice, 2 or 3 is usually a good number.
Private (PPPoE and PPTP only)	This parameter determines if the WR1500 Wireless Router will include the route to this remote node in its RIP broadcasts. If select **Yes,** this route is kept private and not included in RIP broadcast. If select **No,** the route to this remote node will be propagated to other hosts through RIP broadcasts.

Continued on next page

8.4 Configuring WAN IP - Continued

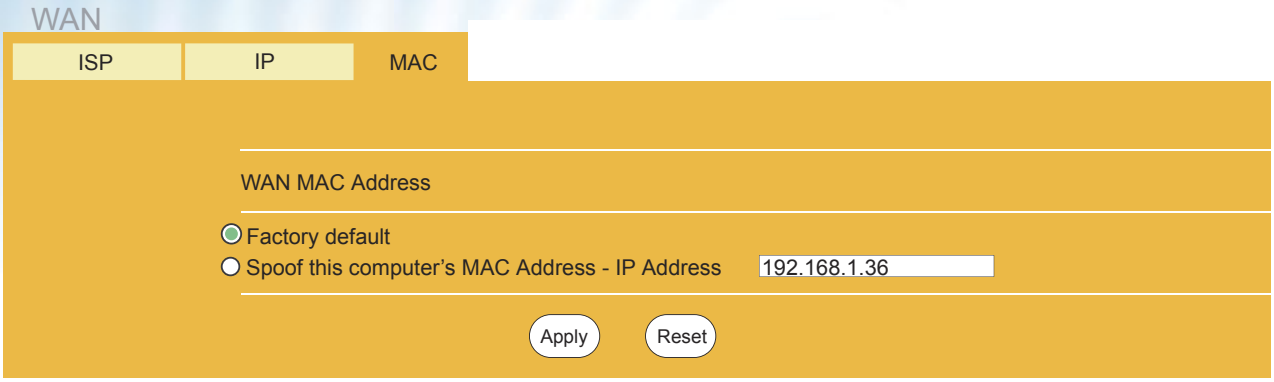
The following table describes the labels on the screen on the preceding pages.

LABEL	DESCRIPTION
RIP Direction	RIP (Routing Information Protocol) allows a router to exchange routing information with other routers. The **RIP Direction** field controls the sending and receiving of RIP packets. Choose **Both, None, In Only** or **Out Only.** When set to **Both** or **Out Only,** the WR1500 Wireless Router will broadcast its routing table periodically. When set to **Both** or **In Only,** the WR1500 Wireless Router will incorporate RIP information that it receives. When set to **None,** the WR1500 Wireless Router will not send any RIP packets and will ignore any RIP packets received. By default, **RIP Direction** is set to **Both.**
RIP Version	The **RIP Version** field controls the format and the broadcasting method of the RIP packets that the WR1500 Wireless Router sends (it recognizes both formats when receiving). Choose **RIP-1, RIP-2B** or **RIP-2M.** **RIP-1** is universally supported; but **RIP-2** carries more information. RIP-1 is probably adequate for most networks, unless you have an unusual network topology. Both **RIP-2B** and **RIP-2M** sends the routing data in RIP-2 format; the difference being that RIP-2B uses subnet broadcasting while RIP-2M uses multicasting. Multicasting can reduce the load on non-router machines since they generally do not listen to the RIP multicast address and so will not receive the RIP packets. However, if one router uses multicasting, then all routers on your network must use multicasting, also. By default, the **RIP Version** field is set to **RIP-1**.
Multicast	Choose **None** (default), **IGMP-V1** or **IGMP-V2.** IGMP (Internet Group Multicast Protocol) is a session-layer protocol used to establish membership in a Multicast group - it is not used to carry user data. IGMP version 2 (RFC 2236) is an improvement over version 1 (RFC 1112) but IGMP version 1 is still in wide use. If you would like to read more detailed information about interoperability between IGMP version 2 and version 1, please see sections 4 and 5 of RFC 2236.
Windows Networking (NetBIOS over TCP/IP): NetBIOS (Network Basic Input/Output System) are TCP or UDP broadcast packets that enable a computer to connect to and communicate with a LAN. For some dial-up services such as PPPoE or PPTP, NetBIOS packets cause unwanted calls.	
Allow From WAN to LAN	Select this option to forward NetBIOS packets from the WAN port to the LAN port.
Allow Trigger Dial	Select this option to allow NetBIOS packets to initiate calls.

Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

8.5 Configuring WAN MAC

To change your WR1500 Wireless Router's WAN MAC settings, click **ADVANCED, WAN** and then the **MAC** tab. The screen appears as shown.



The MAC address screen allows users to configure the WAN port's MAC address by either using the factory default or cloning the MAC address from a computer on your LAN.

Choose **Factory Default** to select the factory assigned default MAC address.

Part IV

SUA (Single User Account)/ NAT (Network Address Translation) and STATIC ROUTE

This part covers the information about SUA/NAT and Static Route setup.

Chapter 9: Single User Account (SUA) / Network Address Translation (NAT)

This chapter discusses how to configure SUA/NAT on the WR1500 Wireless Router.

9.1 NAT Overview

NAT (Network Address Translation - NAT, RFC 1631) is the translation of the IP address of a host in a packet. For example, the source address of an outgoing packet, used within one network is changed to a different IP address known within another network.

9.1.1 NAT Definitions

Inside/outside denotes where a host is located relative to the WR1500 Wireless Router For example, the computers of your subscribers are the inside hosts, while the web servers on the Internet are the outside hosts.

Global/local denotes the IP address of a host in a packet as the packet traverses a router. For example, the local address refers to the IP address of a host when the packet is in the local network, while the global address refers to the IP address of the host when the same packet is traveling in the WAN side.

Note that inside/outside refers to the location of a host, while global/local refers to the IP address of a host used in a packet. Thus, an inside local address (ILA) is the IP address of an inside host in a packet when the packet is still in the local network, while an inside global address (IGA) is the IP address of the same inside host when the packet is on the WAN side.

The following table summarizes this information.

TERM	DESCRIPTION
Inside	This refers to the host on the LAN.
Outside	This refers to the host on the WAN.
Local	This refers to the packet address (source or destination) as the packet travels on the LAN.
Global	This refers to the packet address (source or destination) as the packet travels on the WAN.

NAT never changes the IP address (either local or global) of an outside host.

9.1 NAT Overview - Continued

9.1.2 What NAT Does

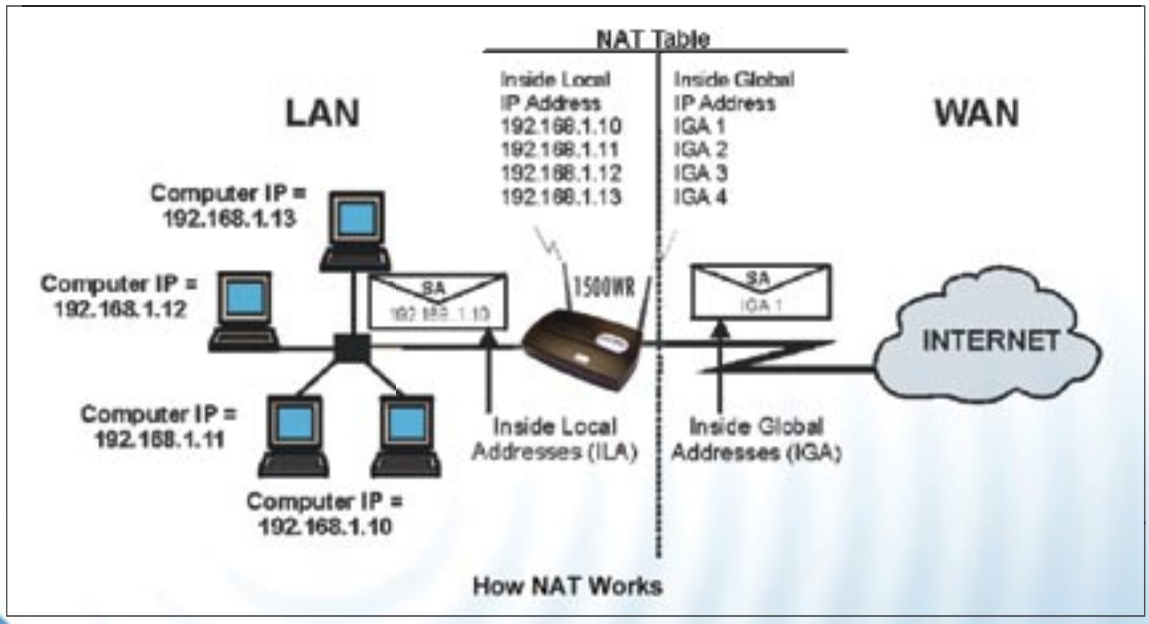
In the simplest form, NAT changes the source IP address in a packet received from a subscriber (the inside local address) to another (the inside global address) before forwarding the packet to the WAN side. When the response comes back, NAT translates the destination address (the inside global address) back to the inside local address before forwarding it to the original inside host. Note that the IP address (either local or global) of an outside host is never changed.

The global IP addresses for the inside hosts can be either static or dynamically assigned by the ISP. In addition, you can designate servers (for example a web server and a telnet server) on your local network and make them accessible to the outside world. Although you can make designated servers on the LAN accessible to the outside world, it is strongly recommended that you attach those servers to the DMZ port instead. If you do not define any servers (for Many-to-One and Many-to-Many Overload mapping), NAT offers the additional benefit of firewall protection. With no servers defined, your WR1500 Wireless Router filters out all incoming inquiries, thus preventing intruders from probing your network. For more information on IP address translation, refer to RFC 1631, The IP Network Address Translator (NAT).

9.1.3 How NAT Works

Each packet has two addresses - a source address and a destination address. For outgoing packets, the ILA (Inside Local Address) is the source address on the LAN, and the IGA (Inside Global Address) is the source address on the WAN. For incoming packets, the ILA is the destination address on the LAN, and the IGA is the destination address on the WAN. NAT maps private (local) IP addresses to globally unique ones required for communication with hosts on other networks. It replaces the original IP source address (and TCP or UDP source port numbers for Many-to-One and Many-to-Many Overload NAT mapping) in each packet and then forwards it to the Internet. The WR1500 Wireless Router keeps track of the original addresses and port numbers so incoming reply packets can have their original values restored.

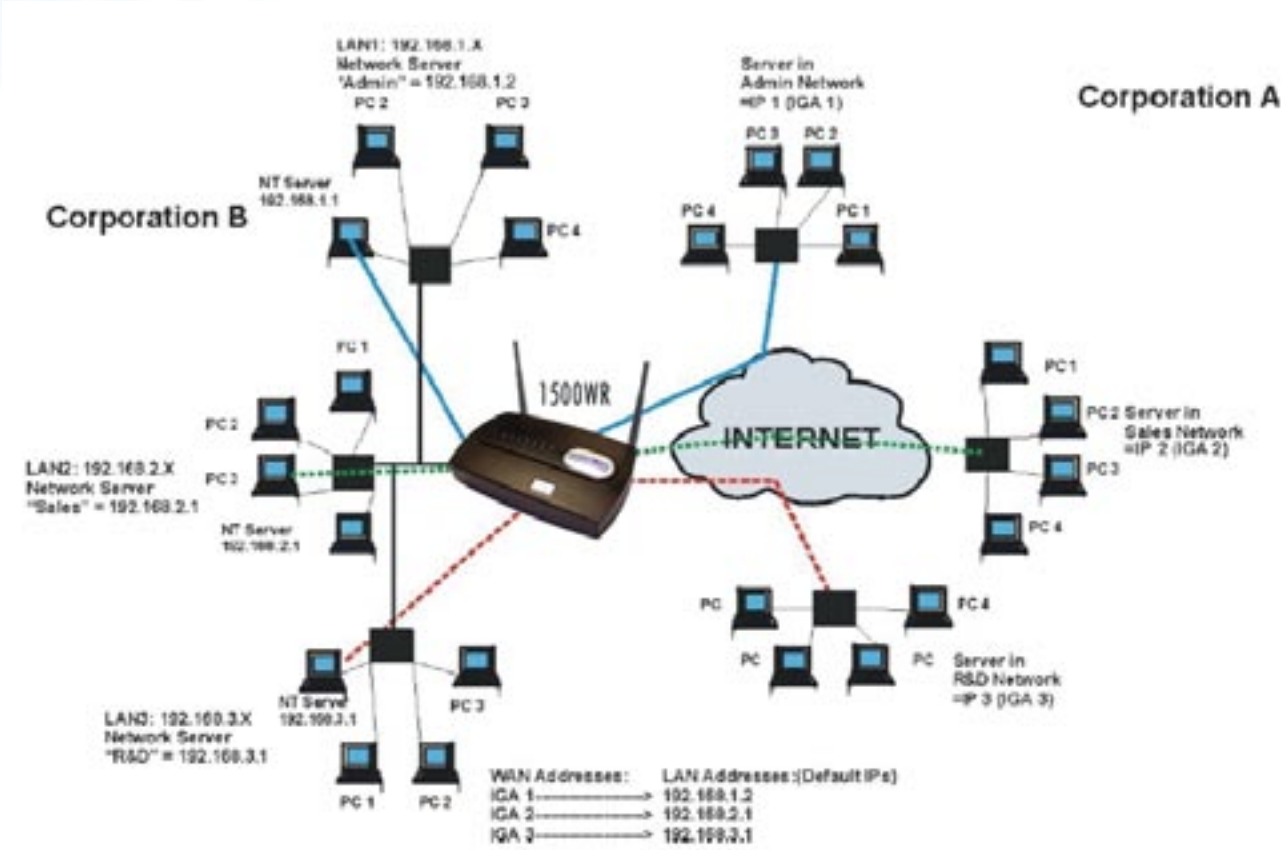
The following figure illustrates this.



9.1 NAT Overview - Continued

9.1.4 NAT Application

The following figure illustrates a possible NAT application, where three inside LANs (logical LANs using IP Alias) behind the WR1500 Wireless Router can communicate with three distinct WAN networks. More examples follow at the end of this chapter.



Application with IP Alias

9.1 NAT Overview - Continued

9.1.5 NAT Mapping Types

NAT supports five types of IP/port mapping. They are:

> **One to One:** In One-to-One mode, the WR1500 Wireless Router maps one local IP address to one global IP address.

> **Many to One:** In Many-to-One mode, the WR1500 Wireless Router maps multiple local IP addresses to one global IP address. This is equivalent to SUA (i.e., PAT, port address translation), ParkerVision's Single User Account feature (the SUA Only option).

> **Many to Many Overload:** In Many-to-Many Overload mode, the WR1500 Wireless Router maps the multiple local IP addresses to shared global IP addresses.

> **Many One to One:** In Many-One-to-One mode, the WR1500 Wireless Router maps each local IP address to a unique global IP address.

> **Server:** This type allows you to specify inside servers of different services behind the NAT to be accessible to the outside world.

Port numbers do not change for One-to-One and Many-One-to-One NAT mapping types.

The following table summarizes these types.

TYPE	IP MAPPING	SMT ABBREVIATION
One-to-One	ILA1 < > IGA1	1-1
Many-to-One (SUA/PAT)	ILA1 < > IGA1 ILA2 < > IGA1	M-1
Many-to-Many Overload	ILA1 < > IGA1 ILA2 < > IGA2 ILA3 < > IGA1 ILA4 < > IGA2	M-MOv
Many-One-to-One	ILA1 < > IGA1 ILA2< > IGA2 ILA3< > IGA3	M-1-1
Server	Server 1 IP< > IGA1 Server 2 IP< > IGA1 Server 3 IP< > IGA1	Server

9.1 NAT Overview - Continued

9.1.6 SUA (Single User Account) Versus NAT

SUA (Single User Account) is a ParkerVision implementation of a subset of NAT that supports two types of mapping, Many-to-One and Server. The WR1500 Wireless Router also supports Full Feature NAT to map multiple global IP addresses to multiple private LAN IP addresses of clients or servers using mapping types. Select either SUA Only or Full Feature in WAN IP.

9.2 SUA Server

An SUA server set is a list of inside (behind NAT on the LAN) servers, for example, web or FTP, that you can make visible to the outside world even though SUA makes your whole inside network appear as a single computer to the outside world.

You may enter a single port number or a range of port numbers to be forwarded, and the local IP address of the desired server. The port number identifies a service; for example, web service is on port 80 and FTP on port 21. In some cases, such as for unknown services or where one server can support more than one service (for example both FTP and web service), it might be better to specify a range of port numbers. You can allocate a server IP address that corresponds to a port or a range of ports.

Many residential broadband ISP accounts do not allow you to run any server processes (such as a Web or FTP server) from your location. Your ISP may periodically check for servers and may suspend your account if it discovers any active services at your location. If you are unsure, refer to your ISP.

Default Server IP Address

In addition to the servers for specified services, NAT supports a default server IP address. A default server receives packets from ports that are not specified in this screen.

If you do not assign a Default Server IP Address, then all packets received for ports not specified in this screen will be discarded.

9.2.1 Port Forwarding: Services and Port Numbers

In addition to the servers for specified services, NAT supports a default server. A service request that does not have a server explicitly designated for it is forwarded to the default server. If the default server is not defined, the service request is simply discarded.

Many residential broadband ISP accounts do not allow you to run any server processes (such as a Web or FTP server) from your location. Your ISP may periodically check for servers and may suspend your account if it discovers any active services at your location. If you are unsure, refer to your ISP.

The most often used port numbers are shown in the table on the following page.

9.2.1 Port Forwarding: Services and Port Numbers - Continued

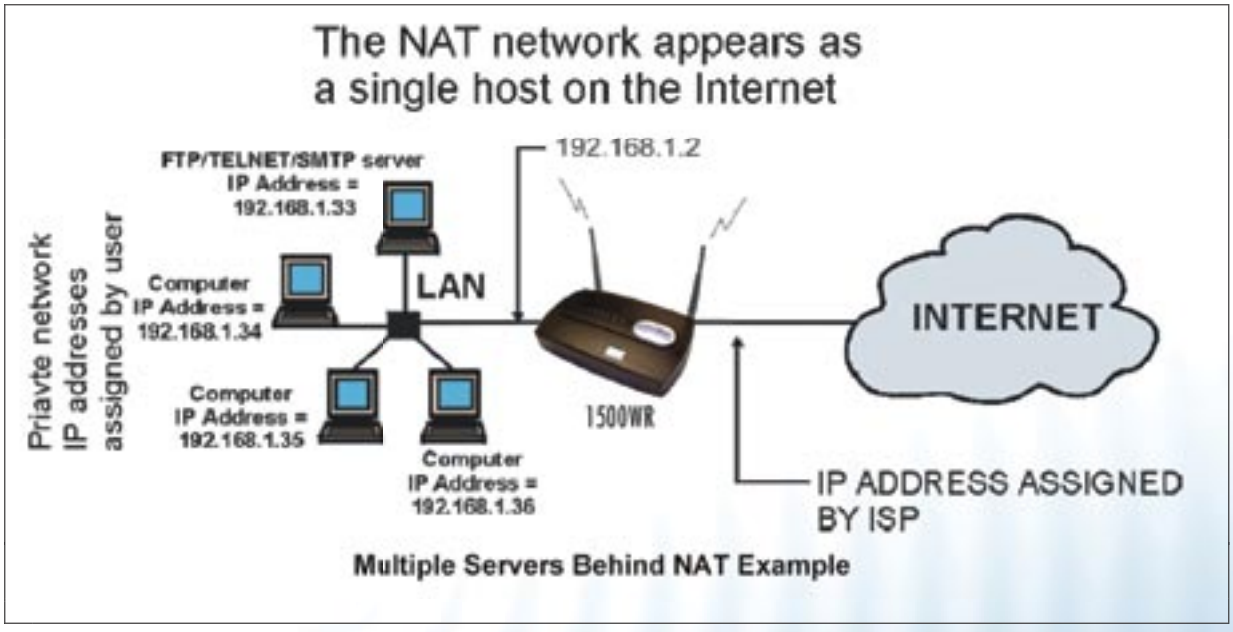
Services and Port Numbers

SERVICES	PORT NUMBER
ECHO	7
FTP (File Transfer Protocol)	21
SMTP (Simple Mail Transfer Protocol)	25
DNS (Domain Name System)	53
Finger	79
HTTP (Hyper Text Transfer protocol or WWW, Web)	80
P0P3 (Post Office Protocol)	110
NNTP (Network News Transport Protocol)	119
SNMP (Simple Network Management Protocol)	161
SNMP trap	162
PPTP (Point-to-Point Tunneling Protocol)	1723

9.2.2 Configuring Servers Behind SUA (Example)

Let's say you want to assign ports 22-25 to one server, port 80 to another and assign a default server IP address of 192.168.1.35 as shown in the figure below.

The NAT network appears as a single host on the Internet



Multiple Servers Behind NAT Example

9.3 Configuring SUA Server

If you do not assign a Default Server IP address, then all packets received for ports not specified in this screen will be discarded.

Click **ADVANCED** and then **SU A/NAT** to open the SUA Server screen. Refer to the table in the previous section for port numbers commonly used for particular services.

The table below describes the settings in this screen.

LABEL	DESCRIPTION
Default Server	In addition to the servers for specified services, NAT supports a default server. A default server receives packets from ports that are not specified in this screen. If you do not assign a default server IP address, then all packets received for ports not specified in this screen will be discarded.
#	This field displays the number of an individual SUA server entry.
Active	Select this check box to enable the SUA server entry. Clear this checkbox to disallow forwarding of these ports to an inside server without having to delete the entry.
Name	Enter a name to identify this port-forwarding rule.
Start Port End Port	Enter a port number here. To forward only one port, enter the port number in the **Start Port** field and then type it again in the **End Port** field. To specify a range of ports, enter the start port number in the **Start Port** field and the last port to be forwarded in the **End Port** field.
Server IP Address	Enter the inside IP address of the server here.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

9.4 Configuring Address Mapping

Ordering your rules is important because the WR1500 Wireless Router applies the rules in the order that you specify. When a rule matches the current packet, the WR1500 Wireless Router takes the corresponding action and the remaining rules are ignored. If there are any empty rules before your new configured rule, your configured rule will be pushed up by that number of empty rules. For example, if you have already configured rules 1 to 6 in your current set and now you configure rule number 9. In the set summary screen, the new rule will be rule 7, not 9. Now if you delete rule 4, rules 5 to 7 will be pushed up by 1 rule, so old rules 5,6 and 7 become new rules 4, 5 and 6.

To change your WR1500 Wireless Router's address mapping settings, click **ADVANCED, SUA/NAT** and then the **Address Mapping tab**. The screen appears as shown.

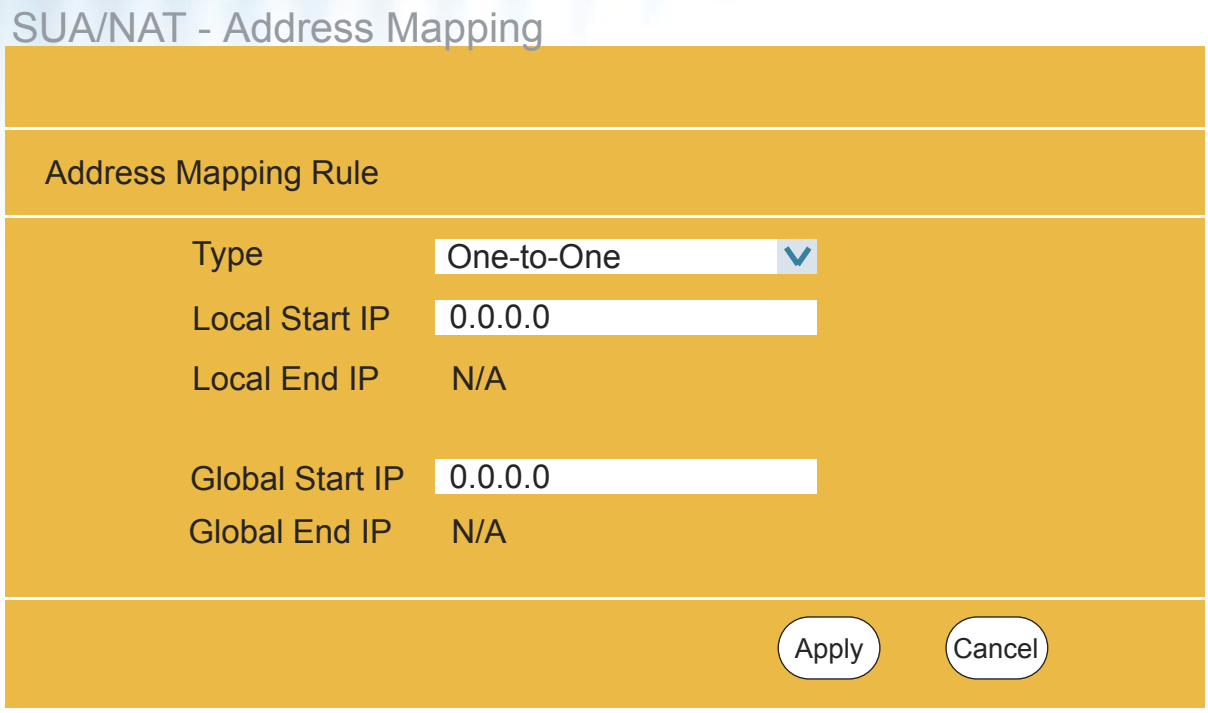
The table below describes the setting in the above screen.

LABEL	DESCRIPTION
#	This field displays the index number of the address mapping rule.
Local Start IP	This refers to the Inside Local Address (ILA), that is the starting local IP address. Local IP addresses are N/A for **Server** port mapping.
Local End IP	This is the end local IP address. If the rule is for all local IP addresses, then this field displays 0.0.0.0 and 255.255.255.255 as the **Local End IP** address. This field is **N/A** for **One-to-One** and **Server** mapping types.
Global Start IP	This refers to the global IP address. 0.0.0.0 is for a dynamic IP address from your ISP with **Many-to-One** and **Server** mapping types.
Global End IP	This is the ending Inside Global Address (IGA), that is the starting global IP address. This field is **N/A** for **One-to-One, Many-to-One** and **Server** mapping types.
Type	Choose the port mapping type from the drop down list.

Insert	Click **Insert** to insert a new mapping rule before an existing one.
Edit	Click **Edit to go to** the **Address Mapping Rule** screen.
Delete	Click **Delete** to delete an address mapping rule.

9.4.1 Configuring Address Mapping Rule

To edit an address mapping rule, click the **Edit** button to display the screen shown next.



The following table describes the labels in this screen.

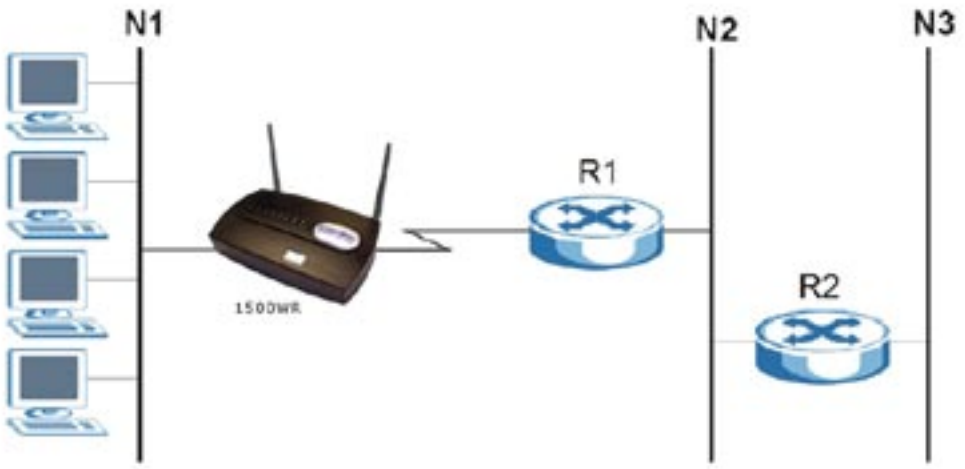
LABEL	DESCRIPTION
Type	Choose the port mapping type from the drop down list.
Local Start IP	This is the starting local IP address (ILA). Local IP addresses are N/A for **Server** port mapping.
Local End IP	This is the end local IP address (ILA). If your rule is for all local IP addresses, then enter 0.0.0.0 as the **Local Start IP** address and 255.255.255.255 as the **Local End IP** address. This field is **N/A** for **One-to-One** and **Server** mapping types.
Global Start IP	This is the starting global IP address (IGA). Enter 0.0.0.0 here if you have a dynamic IP address from your ISP.
Global End IP	This is the ending global IP address (IGA). This field is **N/A** for **One-to-One, Many-to-One** and **Server** mapping types.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Cancel	Click **Cancel** to exit this screen without saving.

Chapter 10: Static Route

This chapter shows you how to configure static routes for your WR1500 Wireless Router.

10.1 Static Route Overview

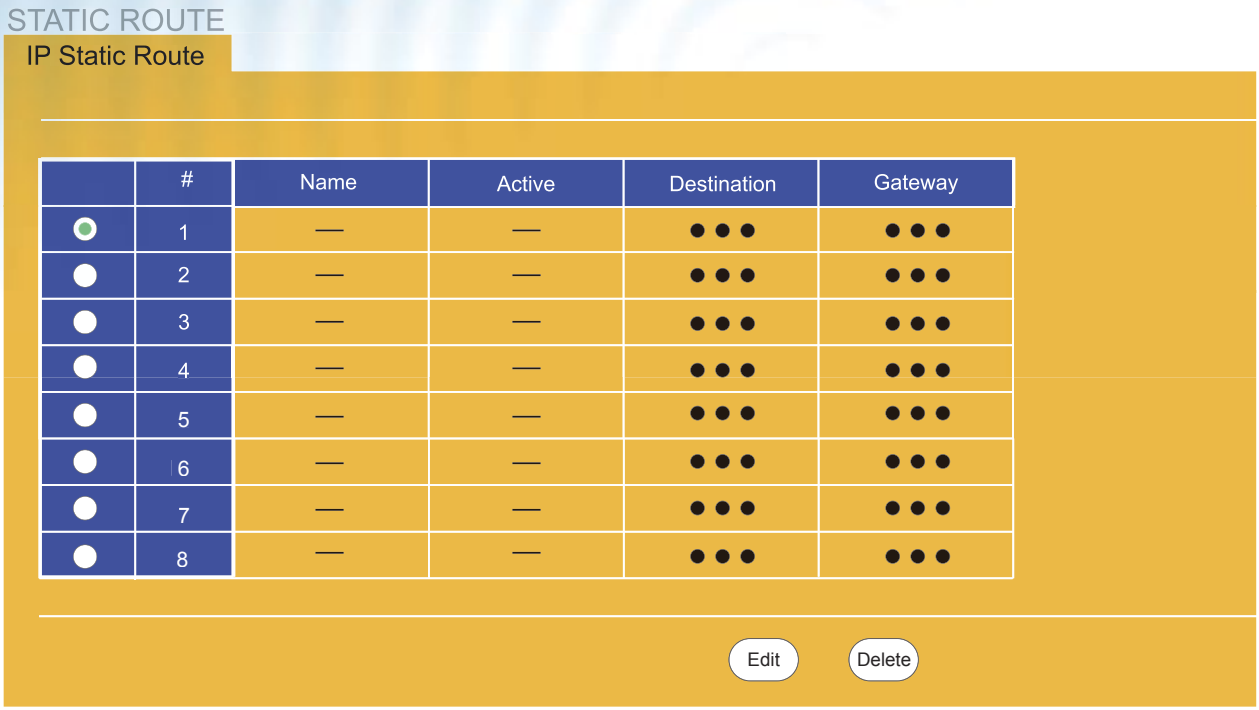
Each remote node specifies only the network to which the gateway is directly connected, and the WR1500 Wireless Router has no knowledge of the networks beyond. For instance, the WR1500 Wireless Router knows about network N2 in the following figure through remote node Router 1. However, the WR1500 Wireless Router is unable to route a packet to network N3 because it doesn't know that there is a route through the same remote node Router 1 (via gateway Router 2). The static routes are for you to tell the WR1500 Wireless Router about the networks beyond the remote nodes.



Example of Static Routing Topology

10.2 Configuring IP Static Route

Click **ADVANCED** and then **STATIC ROUTE** to open the screen shown next.



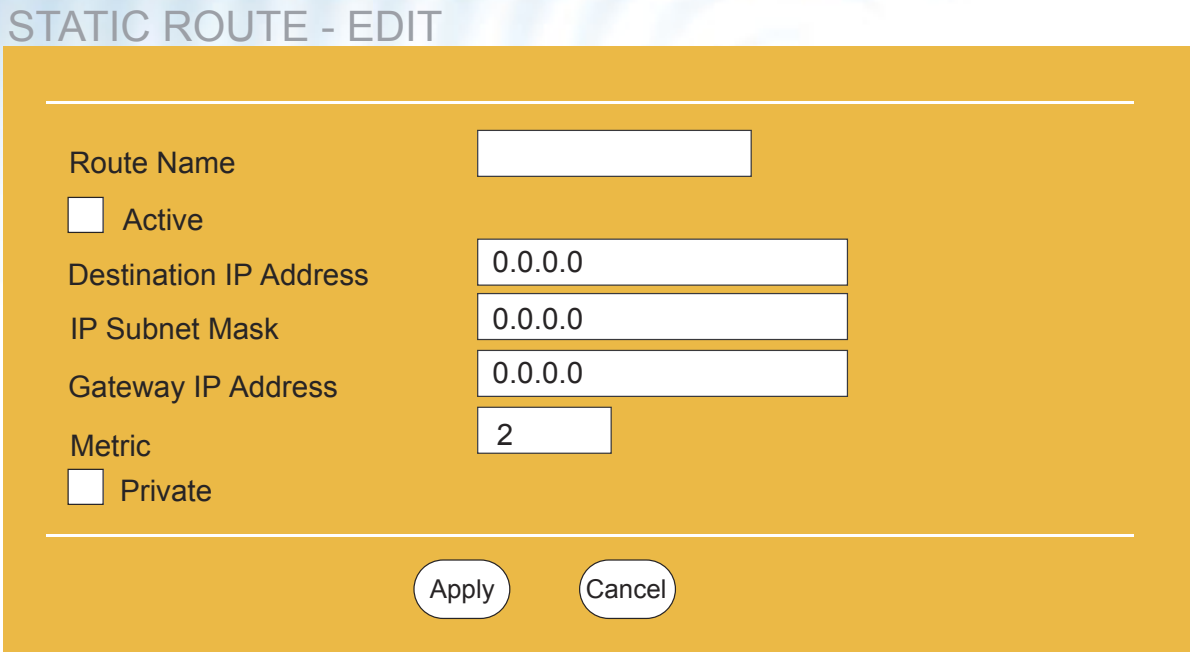
The following table describes the labels in this screen.

IP Static Route Summary

LABEL	DESCRIPTION
#	This field displays an individual static route index number.
Name	This field displays the name that describes or identifies this route.
Active	This field shows whether this static route is active (Yes) or not (No).
Destination	This parameter specifies the IP network address of the final destination. Routing is always based on network number.
Gateway	This field displays the IP address of the gateway. The gateway is an immediate neighbor of your WR1500 Wireless Router that will forward the packet to the destination. On the LAN, the gateway must be a router on the same segment as your WR1500 Wireless Router; over the WAN, the gateway must be the IP address of one of the remote nodes.
Edit	To set up a static route on the WR1500 Wireless Router, click the radio button next to the static route index number you want to configure, then click **Edit** to **go** to the **Static Route -Edit** screen.
Delete	To remove a static route on the WR1500 Wireless Router, click the radio button next to the static route index number you want to remove, then click **Delete.**

10.2.1 Configuring Route Entry

Select a static route index number and click **Edit**. The screen shown next appears. Fill in the required information for each static route.



The following table describes the labels in this screen.

Edit IP Static Route

LABEL	DESCRIPTION
Route Name	Enter a descriptive name for this route. This is for identification purposes only.
Active	Select this check box to activate this static route.
Destination IP Address	Type the IP network address of the final destination. Routing is always based on network number. If you need to specify a route to a single host, use a subnet mask of 255.255.255.255 in the subnet mask field to force the network number to be identical to the host ID.
IP Subnet Mask	Type the IP subnet mask here.
Gateway IP Address	Type the IP address of the gateway. The gateway is an immediate neighbor of your WR1500 Wireless Router that will forward the packet to the destination. On the LAN, the gateway must be a router on the same segment as your WR1500 Wireless Router; over the WAN, the gateway must be the IP address of one of the remote nodes.
Metric	Type a number that approximates the cost for this link. Metric represents the “cost” of transmission for routing purposes. IP routing uses hop count as the measurement of cost, with a minimum of 1 for directly connected networks. The number need not be precise, but it must be between 1 and 15. In practice, 2 or 3 is usually a good number.
Private	This parameter determines if the WR1500 Wireless Router will include the route to this remote node in its RIP broadcasts. If this check box is selected, this route is kept private and not included in RIP broadcast. If it is not selected, the route to this remote node will be propagated to other hosts through RIP broadcasts.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Cancel	Click **Cancel** to exit this screen without saving.

Part V

Firewall and Remote Management

This part introduces firewalls in general and the WR1500 Wireless Router firewall.

It also explains custom ports and gives example firewall rules and information on Remote Management.

Chapter 11: Introduction to Firewalls

This chapter gives some background information on firewalls and introduces the WR1500 Wireless Router firewall.

11.1 Firewall Overview

Originally, the term Firewall referred to a construction technique designed to prevent the spread of fire from one room to another. The networking term "firewall" is a system or group of systems that enforces an access-control policy between two networks. It may also be defined as a mechanism used to protect a trusted network from an untrusted network. Of course, firewalls cannot solve every security problem. A firewall is one of the mechanisms used to establish a network security perimeter in support of a network security policy. It should never be the only mechanism or method employed. For a firewall to guard effectively, you must design and deploy it appropriately. This requires integrating the firewall into a broad information-security policy. In addition, specific policies must be implemented within the firewall itself.

11.2 Types of Firewalls

There are three main types of firewalls:

1. Packet Filtering Firewalls
2. Application-level Firewalls
3. Stateful Inspection Firewalls

11.2.1 Packet Filtering Firewalls

Packet filtering firewalls restrict access based on the source/destination computer network address of a packet and the type of application.

11.2.2 Application-level Firewalls

Application-level firewalls restrict access by serving as proxies for external servers. Since they use programs written for specific Internet services, such as HTTP, FTP and telnet, they can evaluate network packets for valid application-specific data. Application-level gateways have a number of general advantages over the default mode of permitting application traffic directly to internal hosts:

i. Information hiding prevents the names of internal systems from being made known via DNS to outside systems, since the application gateway is the only host whose name must be made known to outside systems.

ii. Robust authentication and logging pre-authenticates application traffic before it reaches internal hosts and causes it to be logged more effectively than if it were logged with standard host logging. Filtering rules at the packet filtering router can be less complex than they would be if the router needed to filter application traffic and direct it to a number of specific systems.

The router need only allow application traffic destined for the application gateway and reject the rest.

11.2.3 Stateful Inspection Firewalls

Stateful inspection firewalls restrict access by screening data packets against defined access rules. They make access control decisions based on IP address and protocol. They also "inspect" the session data to assure the integrity of the connection and to adapt to dynamic protocols. These firewalls generally provide the best speed and transparency; however, they may lack the granular application level access control or caching that some proxies support. See section 11.5 for more information on Stateful Inspection.

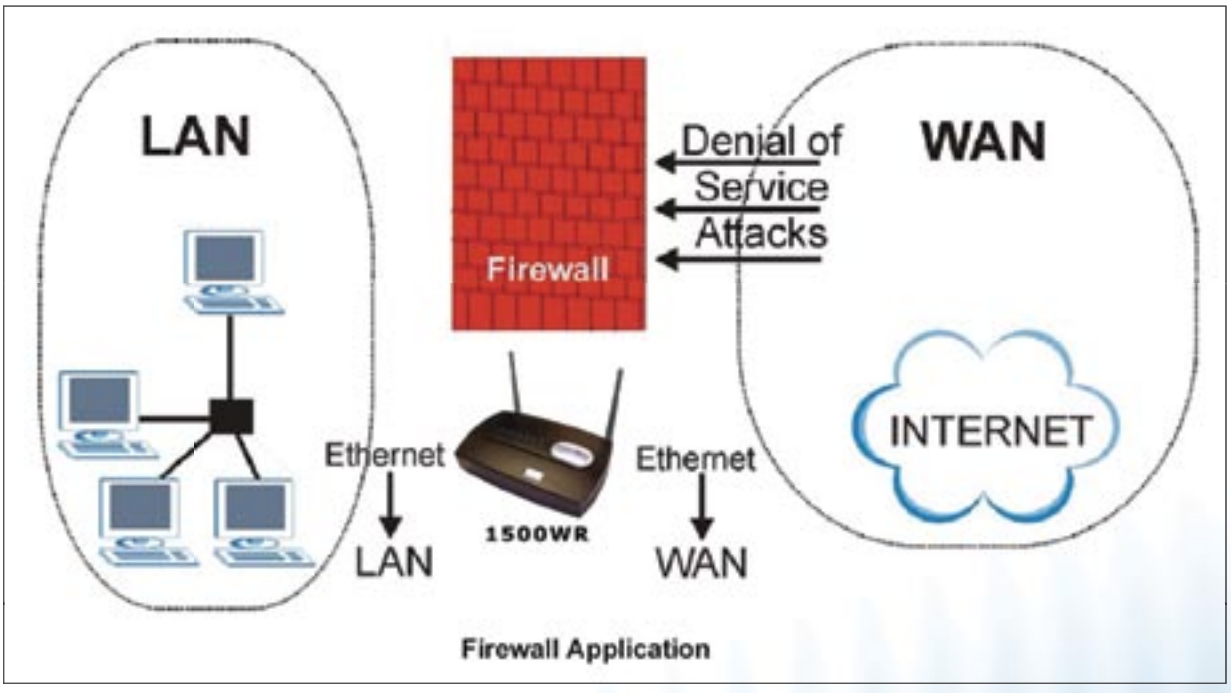
Firewalls, of one type or another, have become an integral part of standard security solutions for enterprises.

11.3 Introduction to ParkerVision's Firewall

The WR1500 Wireless Router firewall is a stateful inspection firewall and is designed to protect against Denial of Service attacks when activated (in SMT menu 21.2 or in the Web Configuration Utility). The WR1500 Wireless Router's purpose is to allow a private Local Area Network (LAN) to be securely connected to the Internet. The WR1500 Wireless Router can be used to prevent theft, destruction and modification of data, as well as log events, which may be important to the security of your network. The WR1500 Wireless Router also has packet-filtering capabilities.

11.4 Denial of Service

Denials of Service (DoS) attacks are aimed at devices and networks with a connection to the Internet. Their goal is not to steal information, but to disable a device or network so users no longer have access to network resources. The WR1500 Wireless Router is pre-configured to automatically detect and thwart all known DoS attacks.



Firewall Application

11.4.1 Basics

Computers share information over the Internet using a common language called TCP/IP. TCP/IP, in turn, is a set of application protocols that perform specific functions. An “extension number”, called the “TCP port” or “UDP port” identifies these protocols, such as HTTP (Web), FTP (File Transfer Protocol), POP3 (E-mail), etc. For example, Web traffic by default uses TCP port 80.

When computers communicate on the Internet, they are using the client/server model, where the server “listens” on a specific TCP/UDP port for information requests from remote client computers on the network. For example, a Web server typically listens on port 80. Please note that while a computer may be intended for use over a single port, such as Web on port 80, other ports are also active. If the person configuring or managing the computer is not careful, a hacker could attack it over an unprotected port.

Some of the most common IP ports are:

Common IP Ports

21	FTP	53	DNS
23	Telnet	80	HTTP
25	SMTP	110	POP3

11.4.2 Types of DoS Attacks

There are four types of DoS attacks:

1. Those that exploit bugs in a TCP/IP implementation.
2. Those that exploit weaknesses in the TCP/IP specification.
3. Brute-force attacks that flood a network with useless data.
4. IP Spoofing.

1. “Ping of Death” and “Teardrop” attacks exploit bugs in the TCP/IP implementations of various computer and host systems.

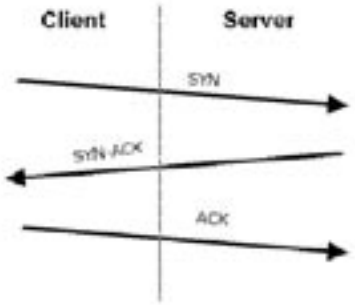
   1-a Ping of Death uses a “ping” utility to create an IP packet that exceeds the maximum 65,536 bytes of data allowed by the IP specification. The oversize packet is then sent to an unsuspecting system. Systems may crash, hang or reboot.

   1-b Teardrop attack exploits weaknesses in the reassembly of IP packet fragments. As data is transmitted through a network, IP packets are often broken up into smaller chunks. Each fragment looks like the original IP packet except that it contains an offset field that says, for instance, “This fragment is carrying bytes 200 through 400 of the original (non fragmented) IP packet.” The Teardrop program creates a series of IP fragments with overlapping offset fields. When these fragments are reassembled at the destination, some systems will crash, hang, or reboot.

2. Weaknesses in the TCP/IP specification leave it open to “SYN Flood” and “LAND” attacks. These attacks are executed during the handshake that initiates a communication session between two applications.

11.4.2 Types of DoS Attacks - Continued

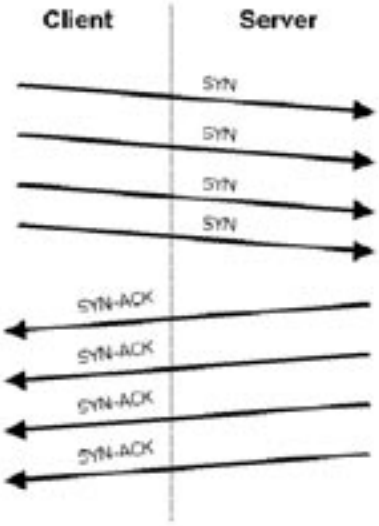
Under normal circumstances, the application that initiates a session sends a SYN (synchronize) packet to the receiving server. The receiver sends back an ACK (acknowledgment) packet and its own SYN, and then the initiator responds with an ACK (acknowledgment). After this handshake, a connection is established.



Three-Way Handshake

2. a) A **SYN Attack** floods a targeted system with a series of SYN packets. Each packet causes the targeted system to issue a SYN-ACK response. While the targeted system waits for the ACK that follows the SYN-ACK, it queues up all outstanding SYN-ACK responses on what is known as a backlog queue. SYN-ACKs are moved off the queue only when an ACK comes back or when an internal timer (which is set at relatively long intervals) terminates the three-way handshake. Once the queue is full, the system will ignore all incoming SYN requests, making the system unavailable for legitimate users.

2. b) In a **LAND Attack**, hackers flood SYN packets into the network with a spoofed source IP address of the targeted system. This makes it appear as if the host computer sent the packets to itself, making the system unavailable while the target system tries to respond to itself.

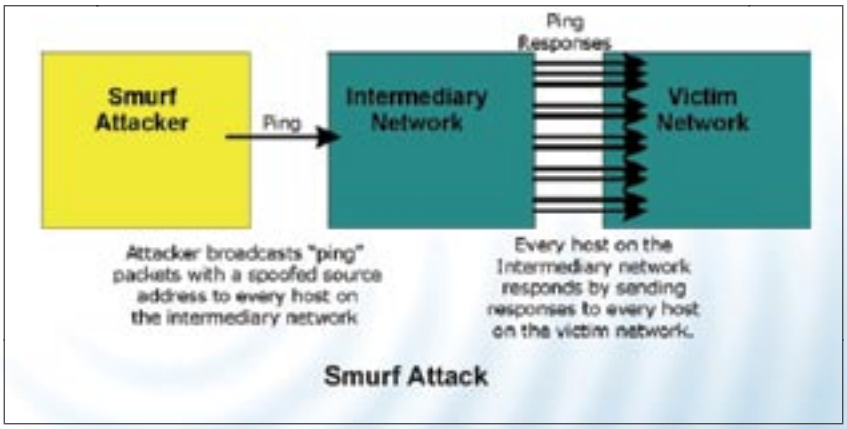


SYN Flood

3. A **brute-force attack**, such as a **"Smurf' attack**, targets a feature in the IP specification known as directed or subnet broadcasting, to quickly flood the target network with useless data. A Smurf hacker floods a router with Internet Control Message Protocol (ICMP) echo request packets (pings). Since the destination IP address of each packet is the broadcast address of the network, the router will broadcast the ICMP echo request packet to all hosts on the network.

If there are numerous hosts, this will create a large amount of ICMP echo request and response traffic. If a hacker chooses to spoof the source IP address of the ICMP echo request packet, the resulting ICMP traffic will not only clog up the "intermediary" network, but will also congest the network of the spoofed source IP address, known as the "victim" network.

This flood of broadcast traffic consumes all available bandwidth, making communications impossible.


Ping Responses
Smurf Attacker
Ping
Intermediary Network
Victim Network
Attacker broadcasts "ping" packets with a spoofed source address to every host on the intermediary network
Every host on the intermediary network responds by sending responses to every host on the victim network.

Smurf Attack

11.4.2 Types of DoS Attacks - Continued

ICMP Vulnerability

ICMP is an error-reporting protocol that works in concert with IP. The following ICMP types trigger an alert:

ICMP Commands That Trigger Alerts

5	REDIRECT
13	TIMESTAMP_REQUEST
14	TIMESTAMP_REPLY
17	ADDRESS_MASK_REQUEST
18	ADDRESS_MASK_REPLY

Illegal Commands (NetBIOS and SMTP)

The only legal NetBIOS commands are the following - all others are illegal.

Legal NetBIOS Commands

MESSAGE:
REQUEST:
POSITIVE:
NEGATIVE:
RETARGET:
KEEPALIVE:

All SMTP commands are illegal except for those displayed in the following table.

Legal SMTP Commands

AUTH	DATA	EHLO	ETRN	EXPN	HELO	HELP	MAIL	NOOP
QUIT	RCPT	RSET	SAML	SEND	SOML	TURN	VRFY	

Traceroute

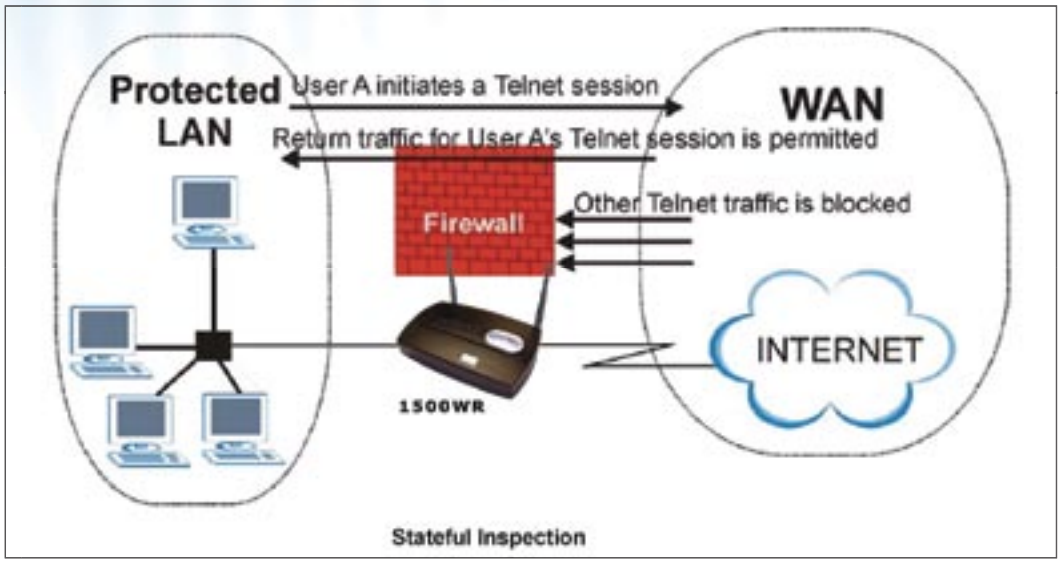
Traceroute is a utility used to determine the path a packet takes between two endpoints. Sometimes when a packet filter firewall is configured incorrectly an attacker can traceroute the firewall gaining knowledge of the network topology inside the firewall.

4. Often, many DoS attacks also employ a technique known as **"IP Spoofing"** as part of their attack. IP Spoofing may be used to break into systems, to hide the hacker's identity, or to magnify the effect of the DoS attack. IP Spoofing is a technique used to gain unauthorized access to computers by tricking a router or firewall into thinking that the communications are coming from within the trusted network. To engage in IP spoofing, a hacker must modify the packet headers so that it appears that the packets originate from a trusted host and should be allowed through the router or firewall. The WR1500 Wireless Router blocks all IP Spoofing attempts.

11.5 Stateful Inspection

Stateful inspection means the WR1500 Wireless Router records packet information, such as port number and source/destination addresses and then allows or denies the response depending on your firewall rules.

The default rules allow LAN-to-WAN traffic and deny traffic initiated from WAN-to-LAN.



Stateful Inspection

The previous figure shows the WR1500 Wireless Router's default firewall rules in action as well as demonstrates how stateful inspection works. User A can initiate a Telnet session from within the LAN and responses to this request are allowed. However other Telnet traffic initiated from the WAN is blocked.

Chapter 12: Firewall Screens

This chapter shows you how to configure your WR1500 Wireless Router firewall.

12.1 Access Methods

The Web Configuration Utility is, by far, the most comprehensive firewall configuration tool your WR1500 Wireless Router has to offer. For this reason, it is recommended that you configure your firewall using the Web Configuration Utility. SMT screens allow you to activate the firewall.

12.2 Firewall Policies Overview

Firewall rules are grouped based on the direction of travel of packets to which they apply:

- LAN to LAN/WR1500 Wireless Router
- WAN to LAN
- LAN to WAN
- WAN to WAN/WR1500 Wireless Router

By default, the WR1500 Wireless Router's stateful packet inspection allows packets traveling in the following directions:

- LAN to LAN/WR1500 Wireless Router

This allows computers on the LAN to manage the WR1500 Wireless Router and communicate between networks or subnets connected to the LAN interface.

- LAN to WAN

By default, the WR1500 Wireless Router's stateful packet inspection blocks packets traveling in the following directions:

- WAN to LAN
- WAN to WAN/WR1500 Wireless Router

This prevents computers on the WAN from using the WR1500 Wireless Router as a gateway to communicate with other computers on the WAN and/or managing the WR1500 Wireless Router.

You may define additional rules and sets or modify existing ones but please exercise extreme caution in doing so.

12.2 Firewall Policies Overview - Continued

If you configure firewall rules without a good understanding of how they work, you might inadvertently introduce security risks to the firewall and to the protected network. Make sure you test your rules after you configure them.

For example, you may create rules to:

- Block certain types of traffic, such as IRC (Internet Relay Chat), from the LAN to the Internet.
- Allow certain types of traffic, such as Lotus Notes database synchronization, from specific hosts on the Internet to specific hosts on the LAN.
- Allow everyone except your competitors to access a Web server.
- Restrict use of certain protocols, such as Telnet, to authorized users on the LAN.

These custom rules work by comparing the Source IP address, Destination IP address and IP protocol type of network traffic to rules set by the administrator. Your customized rules take precedence and override the WR1500 Wireless Router's default rules.

12.3 Rule Logic Overview

Study these points carefully before configuring rules.

12.3.1 Rule Checklist

1. State the intent of the rule. For example, "This restricts all IRC access from the LAN to the Internet." Or, "This allows a remote Lotus Notes server to synchronize over the Internet to an inside Notes server."
2. Is the intent of the rule to forward or block traffic?
3. What direction of traffic does the rule apply to (refer to 12.2)1
4. What IP services will be affected?
5. What computers on the Internet will be affected? The more specific, the better. For example, if traffic is being allowed from the Internet to the LAN, it is better to allow only certain machines on the Internet to access the LAN.

12.3.2 Security Ramifications

Once the logic of the rule has been defined, it is critical to consider the security ramifications created by the rule:

1. Does this rule stop LAN users from accessing critical resources on the Internet? For example, if IRC is blocked, are there users that require this service?

2. Is it possible to modify the rule to be more specific? For example, if IRC is blocked for all users, will a rule that blocks just certain users be more effective?

3. Does a rule that allows Internet users access to resources on the LAN create a security vulnerability? For example, if FTP ports (TCP 20,21) are allowed from the Internet to the LAN, Internet users may be able to connect to computers with running FTP servers.

4. Does this rule conflict with any existing rules?

Once these questions have been answered, adding rules is simply a matter of plugging the information into the correct fields in the Web Configuration Utility screensSource Address.

12.3.3 Key Fields For Configuring Rules Action

Should the action be to Block or Forward?

"Block" means the firewall silently discards the packet.

Service

Select the service from the Service scrolling list box. If the service is not listed, it is necessary to first define it. See section 12.5.3 for more information on predefined services.

Source Address

What is the connection's source address; is it on the LAN or WAN? Is it a single IP, a range of Ips or a subnet?

Destination Address

What is the connection's destination address; is it on the LAN or WAN? Is it a single IP, a range of Ips or a subnet?

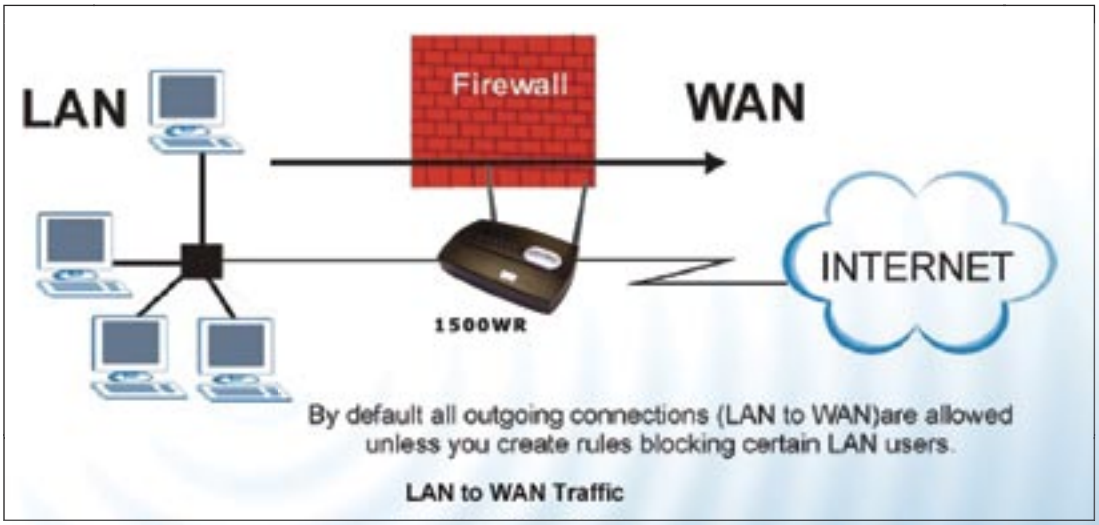
12.4 Connection Direction Examples

This section describes examples for firewall rules for connections going from LAN to WAN and from WAN to LAN.

LAN to LAN/WR1500 Wireless Router and WAN to WAN/WR1500 Wireless Router rules apply to packets coming in on the associated interface (LAN or WAN respectively). LAN to LAN/WR1500 Wireless Router means policies for LAN-to-WR1500 Wireless Router (the policies for managing the WR1500 Wireless Router through the LAN interface) and policies for LAN-to-LAN (the policies that control routing between two subnets on the LAN).

12.4.1 LAN to WAN Rules

The default rule for LAN to WAN traffic is that all users on the LAN are allowed non-restricted access to the WAN. When you configure a LAN to WAN rule, you in essence want to limit some or all users from accessing certain services on the WAN. See the following figure.

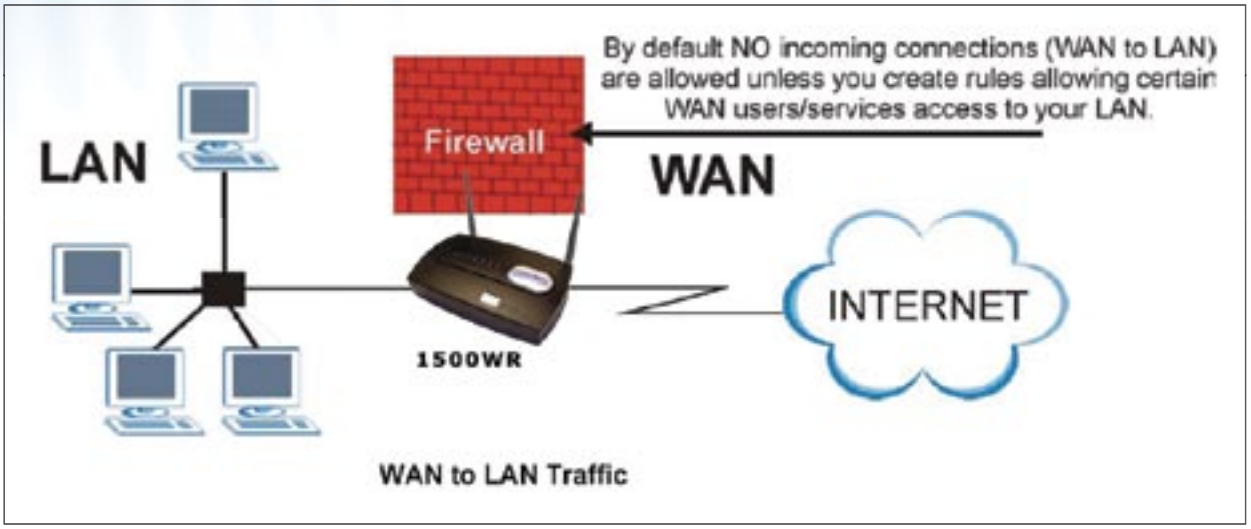


LAN to WAN Traffic

12.4.2 WAN to LAN Rules

The default rule for WAN to LAN traffic blocks all incoming connections (WAN to LAN). If you wish to allow certain WAN users to have access to your LAN, you will need to create custom rules to allow it.

See the following figure.


By default NO incoming connections (WAN to LAN) are allowed unless you create rules allowing certain WAN users/services access to your LAN.
Firewall
LAN
WAN
INTERNET
1500WR
WAN to LAN Traffic

12.5 Enabling Firewall

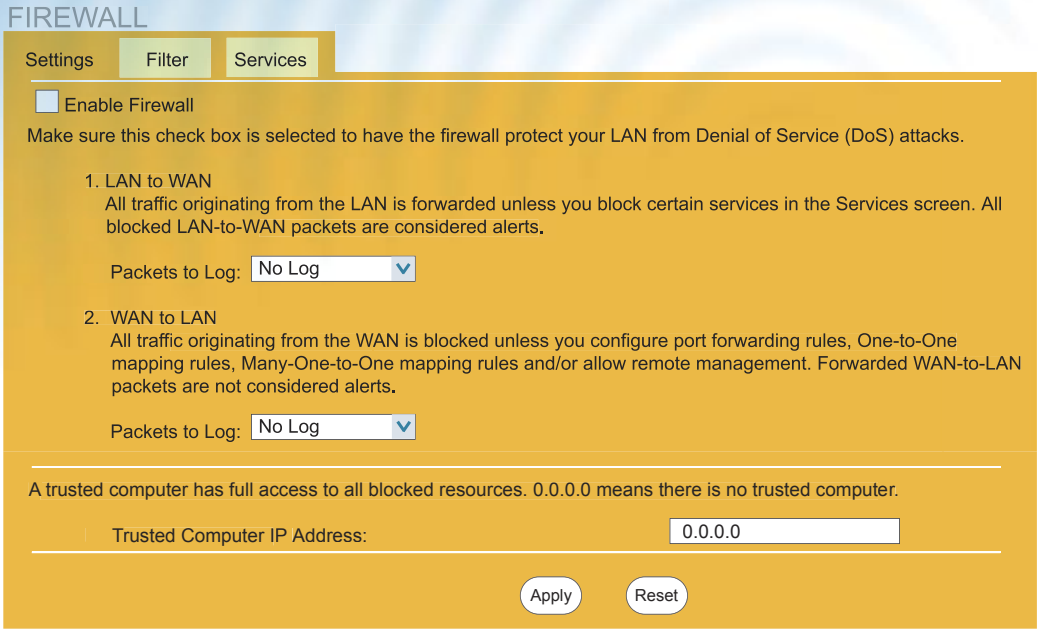
The ordering of your rules is very important as rules are applied in turn.

The default rules allow LAN-to-WAN traffic and deny traffic initiated from WAN-to-LAN. You may block traffic initiated from the LAN by configuring blocked services in the Services screen. You may allow traffic initiated from the WAN by configuring port-forwarding rules, one-to-one/many one-to-one mapping rules and/or allow remote management.

The firewall is automatically enabled when you configure blocked services. When you configure a remote management menu to allow access to the WR1500 Wireless Router, a firewall rule (WAN-to-WAN) is automatically created.

Click **ADVANCED** and **FIREWALL** to open the Settings screen. Enable (or activate) the firewall by selecting the Enable Firewall check box as seen in the screen on the following page.

12.5 Enabling Firewall - Continued


FIREWALL
Settings
Filter
Services
Enable Firewall
Make sure this check box is selected to have the firewall protect your LAN from Denial of Service (DoS) attacks.
1. LAN to WAN
All traffic originating from the LAN is forwarded unless you block certain services in the Services screen. All blocked LAN-to-WAN packets are considered alerts.
Packets to Log:
No Log
2. WAN to LAN
All traffic originating from the WAN is blocked unless you configure port forwarding rules, One-to-One mapping rules, Many-One-to-One mapping rules and/or allow remote management. Forwarded WAN-to-LAN packets are not considered alerts.
Packets to Log:
No Log
A trusted computer has full access to all blocked resources. 0.0.0.0 means there is no trusted computer.
Trusted Computer IP Address:
0.0.0.0
Apply
Reset

The following table describes the labels in this screen.

Firewall Settings

LABEL	DESCRIPTION
Enable Firewall	Select this check box to activate the firewall. The WR1500 Wireless Router performs access control and protects against Denial of Service (DoS) attacks when the firewall is activated.
LAN to WAN	To log packets related to firewall rules, make sure that **Access Control** under **Log** is selected in the **Logs, Log Settings** screen.
Packets to Log	Choose what **LAN to WAN** packets to log. Choose from: • **No Log.** • **Log Blocked** (blocked LAN to WAN services appear in the **Blocked Services.** textbox in the **Services** screen (with **Enable Services Blocking** selected). • **Log All** (log all **LAN to WAN** packets).
WAN to LAN	To log packets related to firewall rules, make sure that **Access Control** under **Log** is selected in the **Logs, Log Settings** screen.
Packets to Log	Choose what **WAN to LAN** and WAN to WAN/Prestige packets to log. Choose from: • **No Log** • **Log Forwarded** • **Log All** (log all **WAN to LAN** packets).
Allow one specific computer full access to all blocked resources.	
Trusted Computer IP Address	You can allow a specific computer to access all Internet resources without restriction. Enter the IP address of the trusted computer in this field.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

12.5.1 Configuring Content Filtering

Content filtering allows you to block web sites by URL keywords that you specify, for example, you can block access to all web sites with the word “bad” in the URL by specifying “bad’ as a keyword.

You can also block access to web proxies and pages containing Active X components, Java applets and cookies. Finally you can schedule when the WR1500 Wireless Router performs content filtering by day and time.

Click **ADVANCED**, **FIREWALL** and then the **Filter tab** to open the Filter screen.

The settings in the screen above are described on the next page.

12.5.1 Configuring Content Filtering - Continued

The following table describes the labels in the screen on the preceding page.

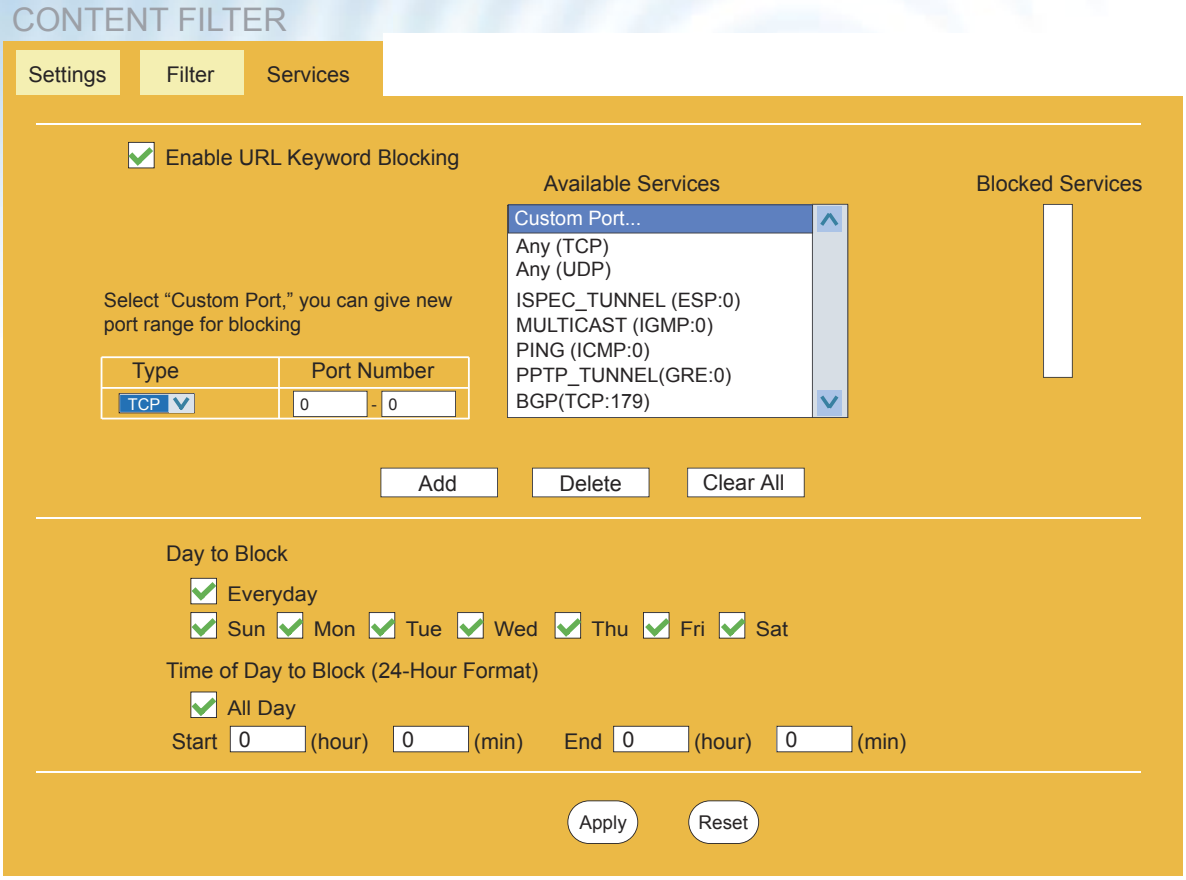
Firewall Filter

LABEL	DESCRIPTION
Restrict Web Features	Select the categories of web features that you want to restrict.
ActiveX	ActiveX is a tool for building dynamic and active Web pages and distributed object applications. When you visit an ActiveX Web site, ActiveX controls are downloaded to your browser, where they remain in case you visit the site again.
Java	Java is a programming language and development environment for building downloadable Web components or Internet and intranet business applications of all kinds.
Cookies	Web servers that track usage and provide service based on ID use cookies.
Web Proxy	This is a server that acts as an intermediary between a user and the Internet to provide security, administrative control, and caching service. When a proxy server is located on the WAN it is possible for LAN users to circumvent content filtering by pointing to this proxy server.
Enable URL Keyword Blocking	Select this check box to block the URL containing the keywords in the keyword list
Keyword	Type a keyword in this field. You may use any character (up to 64 characters). Wildcards are not allowed.
Keyword List	This is a list of keywords that will be inaccessible to computers on your LAN once you enable URL keyword blocking.
Add	Type a keyword in the **Keyword** field and click then **Add** to add a keyword to the **Keyword List.**
Delete	Select a keyword from the **Keyword List** and then click **Delete** to remove this keyword from the list.
Clear All	Click **Clear All** to empty the **Keyword List.**
Day to Block	Select everyday or the day(s) of the week to activate blocking.
Time of Day to Block (24-Hour Format)	Select **All Day** or enter the start and end times in the hour-minute format to activate blocking.
Apply	Click **Apply** to save your customized settings.
Reset	Click **Reset** to reload the previous configuration for this screen.

12.5.2 Configuring Firewall Services

Click **ADVANCED**, **FIREWALL** and then the **Services tab** to open the Services screen. Use this screen to enable service blocking, enter/delete/modify the services you want to block and the date/time you want to block them.

12.5.2 Configuring Firewall Services - Continued



The following table describes the labels in this screen.

Creating/Editing A Firewall Rule

LABEL	DESCRIPTION
Enable Services Blocking	Select the check box to activate service blocking.
Available Services	This is a list of pre-defined services (ports) you may prohibit your LAN computers from using. Select the port you want to block using the drop-down list and click **Add** to add the port to the **Blocked Service** field. Please see *Table 12-4* for more information on services available
Blocked Services	This is a list of services (ports) that will be inaccessible to computers on your LAN once you enable service blocking. Choose the IP port **(TCP, UDP orTCP/UDP)** that defines your customized port from the drop down list box.
Custom Port	A custom port is a service that is not available in the pre-defined **Available Services** list and you must define using the next two fields. For a comprehensive list of port numbers and services, visit the IANA (Internet Assigned Number Authority) web site.

Table continued on next page

12.5.2 Configuring Firewall Services - Continued

Creating/Editing A Firewall Rule - Continued

LABEL	DESCRIPTION
Type	Services are either **TCP** and/or **UDP.** Select from either **TCP** or **UDP.**
Port Number	Enter the port number range that defines the service. For example, suppose you want to define the Gnutella service. Select TCP type and enter a port range from 6345-6349.
Add	Select a service from the **Available Services** drop-down list and then click **Add** to add a service to the Blocked Service.
Delete	Select a service from the **Blocked Services List** and then click **Delete** to remove this service from the list.
Clear All	Click **Clear All** to empty the **Blocked Service.**
Day to Block	Select everyday or the day(s) of the week to activate blocking.
Time of Day to Block (24-Hour Format)	Select the time of day you want service blocking to take effect. Configure blocking to take effect all day by selecting the **All Day** check box. You can also configure specific times that by entering the start time in the **Start (hr)** and **Start (min)** fields and the end time in the **End** (hr) and **End (min)** fields. Enter times in 24-hour format, for example, “3:00pm” should be entered as “15:00”.
Apply	Click **Apply** to save your customized settings.
Reset	Click **Reset** to reload the previous configuration for this screen.

12.5.3 Predefined Services

The Available Services list box in the Services screen displays all predefined services that the WR1500 Wireless Router already supports. Next to the name of the service, two fields appear in brackets.

The first field indicates the IP protocol type (TCP, UDP, or ICMP). The second field indicates the IP port number that defines the service. (Note that there may be more than one IP protocol type.

For example, look at the default configuration labeled “(DNS)”. (UDP/TCP:53) means UDP port 53 and TCP port 53. Up to 128 entries are supported.

Custom services may also be configured using the Custom Ports function discussed later.

See the next page for a list of predefined services.

12.5.3 Predefined Services - Continued

Predefined Services

SERVICE	DESCRIPTION
BGP(TCP:179)	Border Gateway Protocol.
BOOTP_CLIENT(UDP:68)	DHCP Client.
BOOTP_SERVER(UDP:67)	DHCP Server.
CU-SEEME (TCP/UDP: 7648, 24032)	A popular videoconferencing solution from White Pines Software.
DNS(UDP/TCP:53)	Domain Name Server, a service that matches web names (e.g. www.ParkerVision.com) to IP numbers.
FINGER(TCP:79)	Finger is a UNIX or Internet related command that can be used to find out if a user is logged on.
FTP(TCP:20.21)	File Transfer Program, a program to enable fast transfer of files, including large files that may not be possible by e-mail.
HTTP(TCP:80)	Hyper Text Transfer Protocol - a client/server protocol for the world wide web.
ICQ(UDP:4000)	This is a popular Internet chat program.
IPSEC_TUNNEL(ESP:O)	The IPSEC ESP (Encapsulation Security Protocol) tunneling protocol uses this service.
IRC(TCP/UDP:6667)	This is another popular Internet chat program.
MULTICAST(IGMP:O)	Internet Group Multicast Protocol is used when sending packets to a specific group of hosts.
NEWS(TCP:144)	A protocol for news groups.
NFS(UDP:2049)	Network File System - NFS is a client/server distributed file service that provides transparent file sharing for network environments.
NNTP(TCP:119)	Network News Transport Protocol is the delivery mechanism for the USENET newsgroup service.
PING(ICMP:O)	Packet INternet Groper is a protocol that sends out ICMP echo requests to test whether or not a remote host is reachable.
PPTP(TCP:1723)	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the control channel.
PPTP_TUNNEL(GRE:O)	Point-to-Point Tunneling Protocol enables secure transfer of data over public networks. This is the data channel.
RCMD(TCP:512)	Remote Command Service.
REAL_AUDIO(TCP:7070)	A streaming audio service that enables real time sound over the web.
REXEC(TCP:514)	Remote Execution Daemon.
RLOGIN(TCP:513)	Remote Login.
RTELNET(TCP:107)	Remote Telnet.
RTSP(TCP/UDP:554)	The Real Time Streaming (media control) Protocol (RTSP) is a remote control for multimedia on the Internet.
SFTP(TCP:115)	Simple File Transfer Protocol.
SMTP(TCP:25)	Simple Mail Transfer Protocol is the message-exchange standard for the Internet. SMTP enables you to move messages from one e-mail server to another.

12.5.3 Predefined Services - Continued

Predefined Services

SERVICE	DESCRIPTION
SNMP(TCP/UDP:161)	Simple Network Management Program.
SNMP-TRAPS(TCP/ UDP:162)	Traps for use with the SNMP (RFC:1215).
SQL-NET(TCP:1521)	Structured Query Language is an interface to access data on many different types of database systems, including mainframes, midrange systems, UNIX systems and network servers.
SSH(TCP/UDP:22)	Secure Shell Remote Login Program.
STRM WORKS(UDP:1558)	Stream Works Protocol.
TELNET(TCP:23)	Telnet is the login and terminal emulation protocol common on the Internet and in UNIX environments. It operates over TCP/IP networks. Its primary function is to allow users to log into remote host systems.
TFTP(UDP:69)	Trivial File Transfer Protocol is an Internet file transfer protocol similar to FTP, but uses the UDP (User Datagram Protocol) rather than TCP (Transmission Control Protocol).
VDOLIVE(TCP:7000)	Another videoconferencing solution.

Chapter 13:
Remote Management

This chapter provides information on the Remote Management screens.

13.1 Remote Management Overview

Remote management allows you to determine which services/protocols can access which WR1500 Wireless Router interface (if any) from which computers. You can customize the service port, access interface and the secured client IP address to enhance security and flexibility.

When you configure remote management to allow management from the WAN, you still need to configure a firewall rule to allow access. See the firewall chapters for details on configuring firewall rules.

You may manage your WR1500 Wireless Router from a remote location via:

- Internet (WAN only)
- LAN only,
- ALL (LAN and WAN)
- Neither (Disable).

When you Choose WAN only or ALL (LAN & WAN), you still need to configure a firewall rule to allow access.

To disable remote management of a service, select Disable in the corresponding Server Access field.

13.1.1 Remote Management Limitations

Remote management over LAN or WAN will not work when:

1. A filter in SMT menu 3.1 (LAN) or in menu 11.5 (WAN) is applied to block a Telnet, FTP or Web service.
2. You have disabled that service in one of the remote management screens.
3. The IP address in the Secured Client IP field does not match the client IP address. If it does not match, the WR1500 Wireless Router will disconnect the session immediately.
4. There is an SMT console session running.
5. There is already another remote management session of the same type (web, FTP or Telnet) running. You may only have one remote management session of the same type running at one time.
6. There is a web remote management session running with a Telnet session. A Telnet session will be disconnected if you begin a web session; it will not begin if there already is a web session.

13.1.2 Remote Management and NAT

When NAT is enabled:

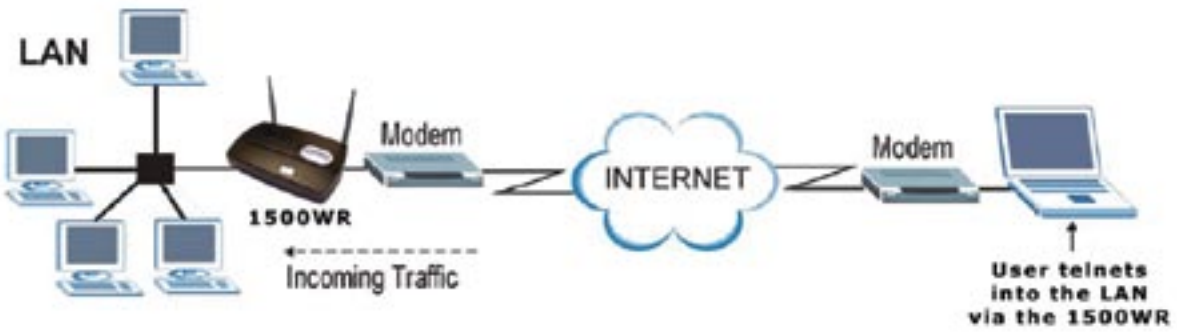
- Use the WR1500 Wireless Router's WAN IP address when configuring from the WAN.
- Use the WR1500 Wireless Router's LAN IP address when configuring from the LAN.

13.1.3 System Timeout

There is a system timeout of five minutes (three hundred seconds) for either the console port or telnet/web/FTP connections. Your WR1500 Wireless Router automatically logs you out if you do nothing in this timeout period, except when it is continuously updating the status in menu 24.1 or when sys stdio has been changed on the command line.

13.2 Telnet

You can telnet into the WR1500 Wireless Router to perform remote management.

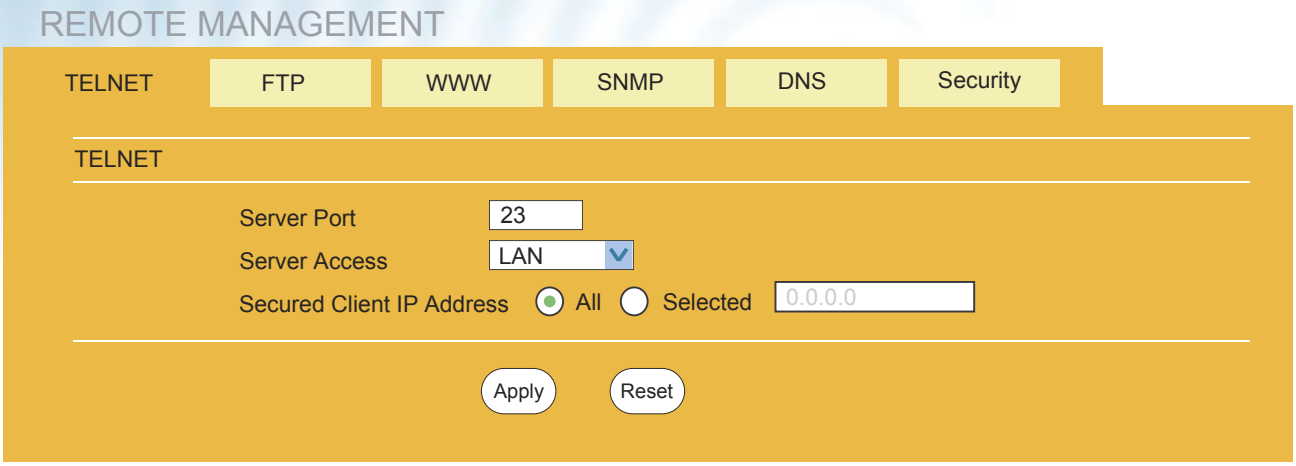


Telnet Configuration on a TCP/IP Network

13.3 Configuring TELNET

Click **ADVANCED** and then **REMOTE MANAGEMENT** to open the **TELNET** screen, shown on the next page.

13.3 Configuring TELNET - Continued



The following table describes the labels in this screen.

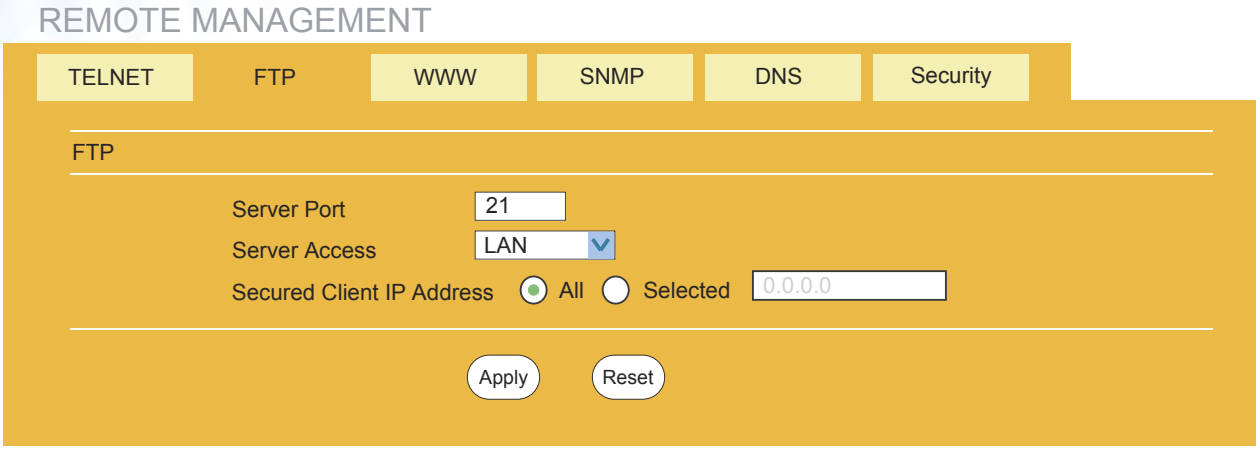
Telnet

LABEL	DESCRIPTION
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Access	Select the interface(s) through which a computer may access the WR1500 Wireless Router using this service.
Secured Client IP Address	A secured client is a “trusted” computer that is allowed to communicate with the WR1500 Wireless Router using this service. Select **All** to allow any computer to access the WR1500 Wireless Router using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the WR1500 Wireless Router using this service.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

13.4 Configuring FTP

You can upload and download the WR1500 Wireless Router's firmware and configuration files using FTP, please see the chapter on firmware and configuration file maintenance for details. To use this feature, your computer must have an FTP client.

To change your WR1500 Wireless Router's FTP settings, click **ADVANCED**, **REMOTE MANAGEMENT** and then the **FTP** tab. The screen appears as shown.



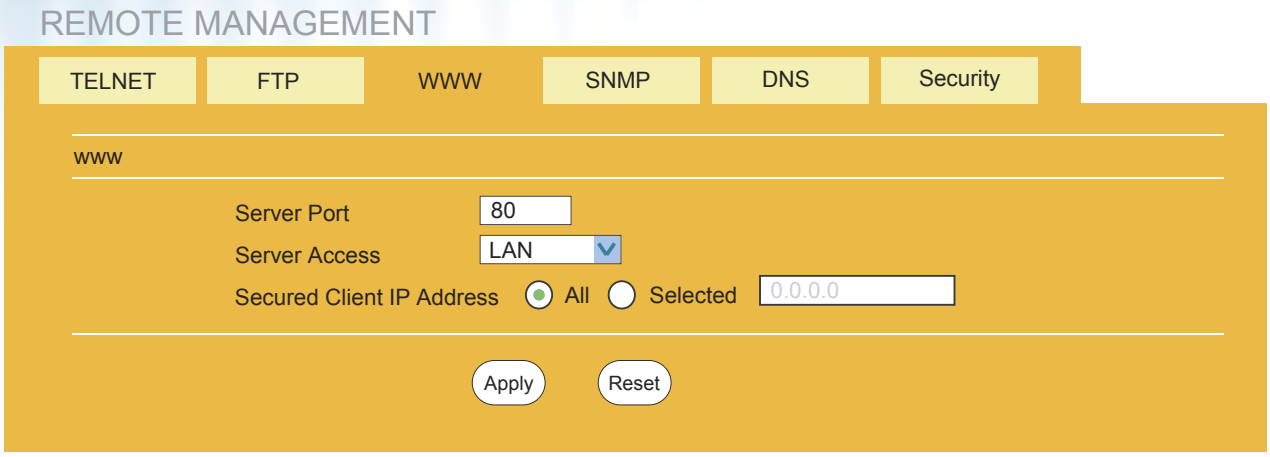
The following table describes the labels in this screen.

FTP

LABEL	DESCRIPTION
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Access	Select the interface(s) through which a computer may access the WR1500 Wireless Router using this service.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to communicate with the WR1500 Wireless Router using this service. Select **All** to allow any computer to access the WR1500 Wireless Router using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the WR1500 Wireless Router using this service.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

13.5 Configuring WWW

To change your WR1500 Wireless Router's World Wide Web settings, click **ADVANCED**, **REMOTE MANAGEMENT** and then the **WWW** tab. The screen appears as shown.



The following table describes the labels in this screen.

WWW

LABEL	DESCRIPTION
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Access	Select the interface(s) through which a computer may access the WR1500 Wireless Router using this service.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to communicate with the WR1500 Wireless Router using this service. Select **All** to allow any computer to access the WR1500 Wireless Router using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the WR1500 Wireless Router using this service.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

13.6 Configuring SNMP

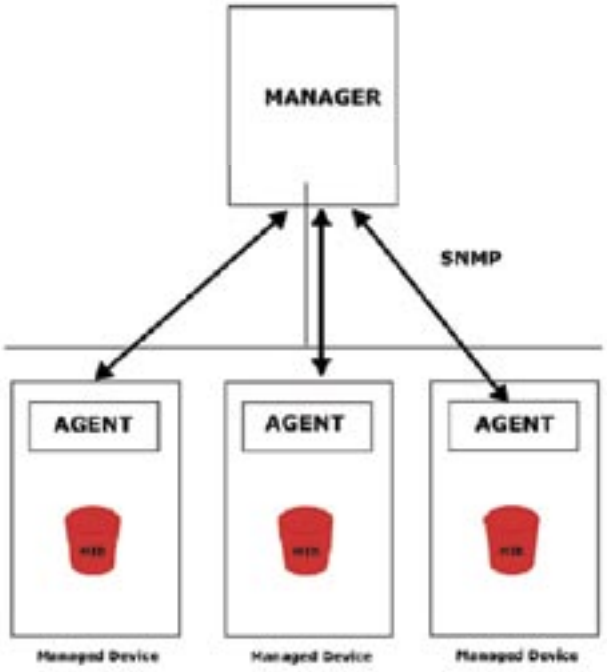
Simple Network Management Protocol is a protocol used for exchanging management information between network devices. SNMP is a member of the TCP/IP protocol suite. Your WR1500 Wireless Router supports SNMP agent functionality, which allows a manager station to manage and monitor the WR1500 Wireless Router through the network. The WR1500 Wireless Router supports SNMP version one (SNMPvl) and version two c (SNMPv2c).

The next figure illustrates an SNMP management operation. SNMP is only available if TCP/IP is configured.

An SNMP managed network consists of two main types of component: agents and a manager.

An agent is a management software module that resides in a managed device (the WR1500 Wireless Router). An agent translates the local management information from the managed device into a form compatible with SNMP. The manager is the console through which network administrators perform network management functions. It executes applications that control and monitor managed devices.

The managed devices contain object variables/managed objects that define each piece of information to be collected about a device. Examples of variables include the number of packets received, node port status etc. A Management Information Base (MIB) is a collection of managed objects. SNMP allows a manager and agents to communicate for the purpose of accessing these objects.



SNMP Management Model

SNMP itself is a simple request/response protocol based on the manager/agent model. The manager issues a request and the agent returns responses using the following protocol operations:

- Get - Allows the manager to retrieve an object variable from the agent.
- GetNext - Allows the manager to retrieve the next object variable from a table or list within an agent. In SNMPvl, when a manager wants to retrieve all elements of a table from an agent, it initiates a Get operation, followed by a series of GetNext operations.
- Set - Allows the manager to set values for object variables within an agent.
- Trap - Used by the agent to inform the manager of some events.

13.6.1 Supported MIBs

The WR1500 Wireless Router supports MIB II that is defined in RFC-1213 and RFC-1215. The focus of the MIBs is to let administrators collect statistical data and monitor status and performance.

13.6.2 SNMP Traps

The WR1500 Wireless Router will send traps to the SNMP manager when any one of the following events occurs:

SNMP Traps

TRAP*	TRAP NAME	DESCRIPTION
1	coldStart *(defined in RFC-1215)*	A trap is sent after booting (power on).
2	warmStart *(defined in RFC-1215)*	A trap is sent after booting (software reboot).
3	NnkUp *(defined in RFC-1215)*	A trap is sent when the port is up.
4	authenticationFailure *(defined in RFC-1215)*	A trap is sent to the manager when receiving any SNMP get or set requirements with wrong community (password).
6	NnkDown *(defined in RFC-1215)*	A trap is sent when the port is down.

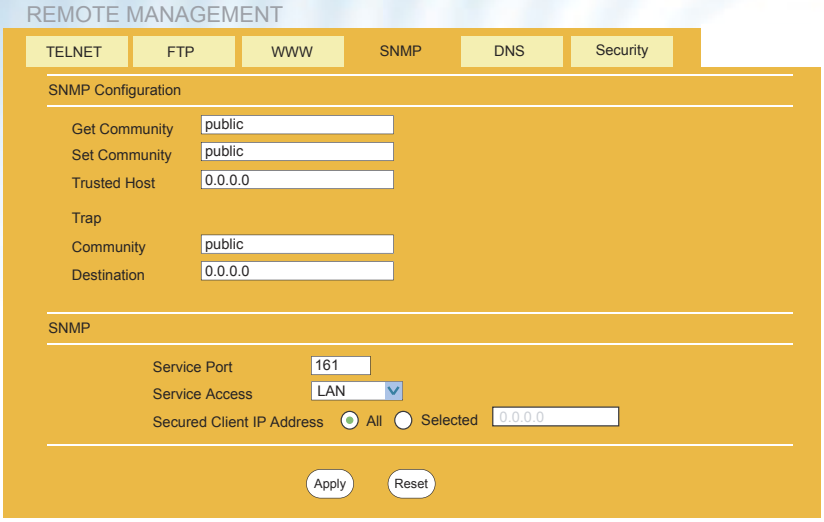
The following table maps the physical port and encapsulation to the interface type.

Ports and Interface Types

PHYSICAL PORT/ENCAP	INTERFACE TYPE
LAN port(s)	enetO
Wireless port	eneti
PPPoE encap	pppoe
1483 encap	mpoa
Ethernet encap	enet-encap
PPPoA	PPP

13.6.3 REMOTE MANAGEMENT: SNMP

To change your WR1500 Wireless Router's SNMP settings, click **ADVANCED**, **REMOTE MANAGEMENT** and then the **SNMP tab**. The screen appears as shown.



The following table describes the labels in this screen.

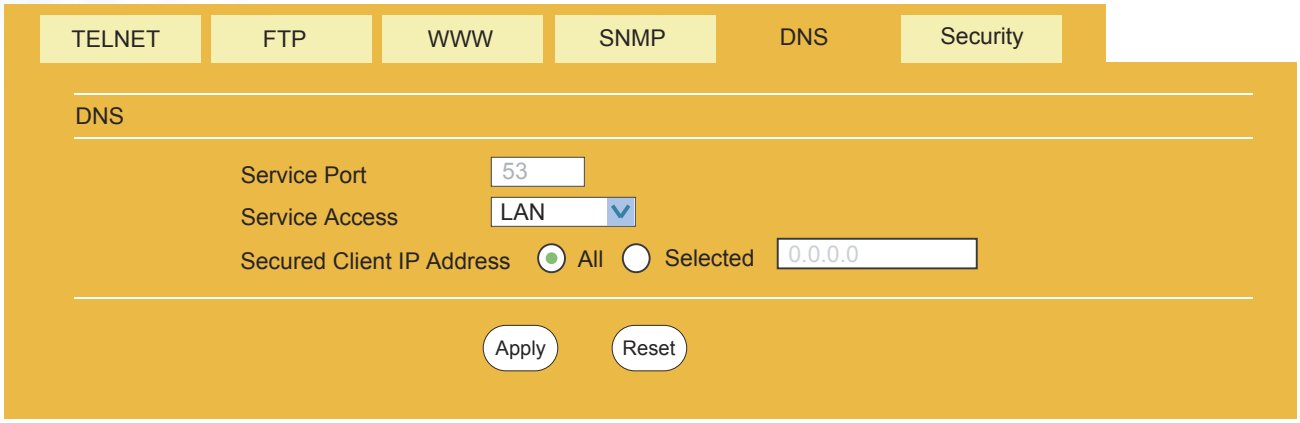
SNMP

LABEL	DESCRIPTION
SNMP Configuration	
Get Community	Enter the **Get Community,** which is the password for the requests from the management station. incoming Get and GetNext.
Set Community	Enter the **Set community,** which is the password for incoming Set requests from the management station.
Trusted Host	If you enter a trusted host, your WR1500 Wireless Router will only respond to SNMP messages from this address. A blank (default) field means your WR1500 Wireless Router will respond to all SNMP messages it receives, regardless of source.
Trap	
Community	Type the trap community, which is the password sent with each trap to the SNMP manager.
Destination	Type the IP address of the station to send your SNMP traps to.
SNMP	
Server Port	You may change the server port number for a service if needed, however you must use the same port number in order to use that service for remote management.
Server Access	Select the interface(s) through which a computer may access the WR1500 Wireless Router using this service.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to communicate with the WR1500 Wireless Router using this service. Select **All** to allow any computer to access the WR1500 Wireless Router using this service. Choose **Selected** to just allow the computer with the IP address that you specify to access the WR1500 Wireless Router using this service.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

13.7 Configuring DNS

Use DNS (Domain Name System) to map a domain name to its corresponding IP address and vice versa, for example, the IP address of www.parkervision.com is 204.217.0.2. Refer to the Internet Access chapter for more information.

To change your WR1500 Wireless Router's DNS settings, click **ADVANCED**, **REMOTE MANAGEMENT** and then the **DNS tab**. The screen appears as shown.



The following table describes the labels in this screen.

DNS

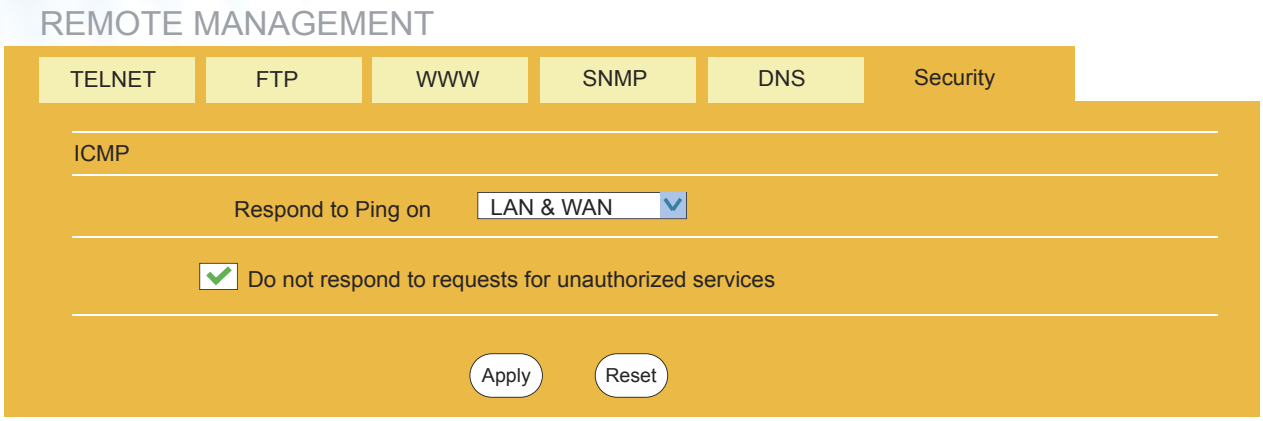
LABEL	DESCRIPTION
Server Port	The DNS service port number is 53 and cannot be changed here.
Server Access	Select the interface(s) through which a computer may send DNS queries to the WR1500 Wireless Router.
Secured Client IP Address	A secured client is a "trusted" computer that is allowed to send DNS queries to the WR1500 Wireless Router. Select **All** to allow any computer to send DNS queries to the WR1500 Wireless Router. Choose **Selected** to just allow the computer with the IP address that you specify to send DNS queries to the WR1500 Wireless Router.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

NOTE - If you modify the port numbers, you should choose different port numbers for each service, and ensure that the port numbers you choose are not default ports for other common services.

13.8 Configuring Security

To change your WR1500 Wireless Router's security settings, click **ADVANCED**, **REMOTE MANAGEMENT** and then the **Security tab**. The screen appears as shown.

If an outside user attempts to probe an unsupported port on your WR1500 Wireless Router, an ICMP response packet is automatically returned. This allows the outside user to know the WR1500 Wireless Router exists. The WR1500 Wireless Router series support anti-probing, which prevents the ICMP response packet from being sent. This keeps outsiders from discovering your WR1500 Wireless Router when unsupported ports are probed.



The following table describes the labels in this screen.

Security

LABEL	DESCRIPTION
ICMP	Internet Control Message Protocol is a message control and error-reporting protocol between a host server and a gateway to the Internet. ICMP uses Internet Protocol (IP) datagrams, but the messages are processed by the TCP/IP software and directly apparent to the application user.
Respond to Ping on	The WR1500 Wireless Router will not respond to any incoming Ping requests when **Disable** is selected. Select **LAN** to reply to incoming LAN Ping requests. Select **WAN** to reply to incoming WAN Ping requests. Otherwise select **LAN&WAN** to reply to both incoming LAN and WAN Ping requests.
Do not respond to requests for unauthorized services	Select this option to prevent hackers from finding the WR1500 Wireless Router by probing for unused ports. If you select this option, the WR1500 Wireless Router will not send ICMP response packets to port request(s) for unused ports, thus leaving the unused ports and the WR1500 Wireless Router unseen. If the firewall blocks a packet from the WAN, the WR1500 Wireless Router sends a TCP reset packet. Use the "sys firewall tcprst rst off' command in the command interpreter if you want to stop the WR1500 Wireless Router from sending TCP reset packets.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

Part VI

UPnP and LOGS

This part provides information and configuration instructions for UPnP (Universal Plug and Play) and the logs.

Chapter 14:
UPnP Screen

This chapter introduces the Universal Plug and Play feature of the WR1500.

14.1 Universal Plug and Play Overview

Universal Plug and Play (UPnP) is a distributed, open networking standard that uses TCP/IP for simple peer-to-peer network connectivity between devices. A UPnP device can dynamically join a network, obtain an IP address, convey its capabilities and learn about other devices on the network. In turn, a device can leave a network smoothly and automatically when it is no longer in use.

14.1.1 How Do I Know If I'm Using UPnP?

UPnP hardware is identified as an icon in the Network Connections folder (Windows XP). Each UPnP compatible device installed on your network will appear as a separate icon. Selecting the icon of a UPnP device will allow you to access the information and properties of that device.

14.1.2 NAT Traversal

UPnP NAT traversal automates the process of allowing an application to operate through NAT. UPnP network devices can automatically configure network addressing, announce their presence in the network to other UPnP devices and enable exchange of simple product and service descriptions. NAT traversal allows the following:

- Dynamic port mapping
- Learning public IP addresses
- Assigning lease times to mappings

Windows Messenger is an example of an application that supports NAT traversal and UPnP. See the SUA/NAT chapter for further information about NAT.

14.2 Cautions with UPnP

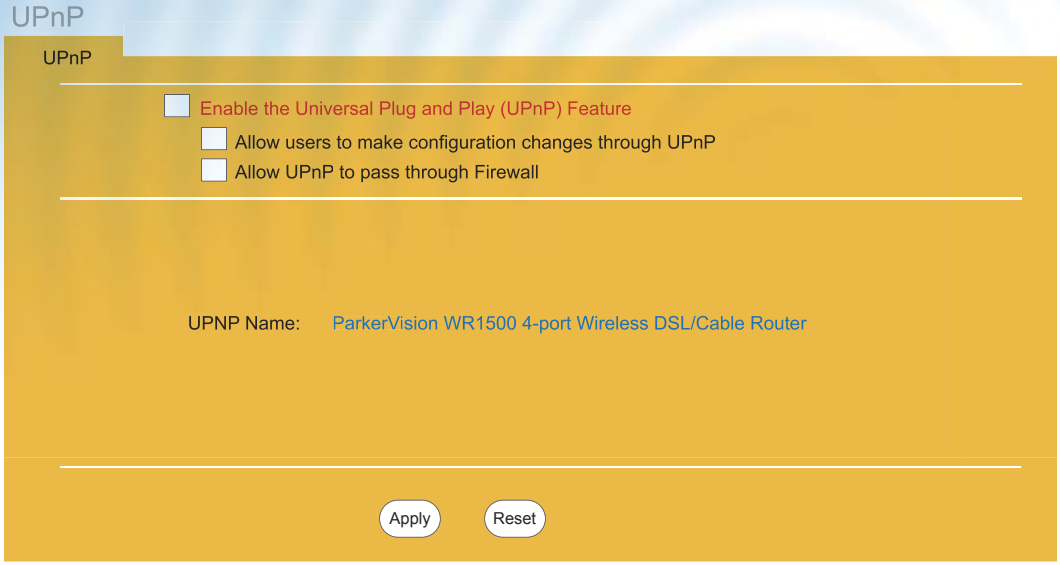
The automated nature of NAT traversal applications in establishing their own services and opening firewall ports may present network security issues. Network information and configuration may also be obtained and modified by users in some network environments.

All UPnP-enabled devices may communicate freely with each other without additional configuration. Disable UPnP if this is not your intention.

14.3 Configuring UPnP

Click **ADVANCED** and then **UPnP** to display the screen shown on the next page.

14.3 Configuring UPnP - Continued



The following table describes the labels in this screen.

Configuring UPnP

LABEL	DESCRIPTION
Enable the Universal Plug and Play (UPnP) feature	Select this check box to activate UPnP. Be aware that anyone could use a UPnP application to open the Web Configuration Utility's login screen without entering the WR1500 Wireless Router's IP address (although you must still enter the password to access the Web Configuration Utility).
Allow users to make configuration changes through UPnP	Select this check box to allow UPnP-enabled applications to automatically configure the WR1500 Wireless Router so that they can communicate through the WR1500 Wireless Router, for example by using NAT traversal, UPnP applications automatically reserve a NAT forwarding port in order to communicate with another UPnP enabled device; this eliminates the need to manually configure port forwarding for the UPnP enabled application.
Allow UPnP to pass through Firewall	Select this check box to create a static LAN to LAN/WR1500 Wireless Router rule that allows forwarding of ports 1900 and 80. Selecting this check box also creates a dynamic firewall rule every time a NAT forwarding port is reserved for UPnP. This setting remains active until you disable UPnP or clear this check box. Clear this check box to have the firewall block all UPnP application packets (for example, MSN packets) instead of creating a firewall rule for them.
UPnP Name	This identifies the WR1500 Wireless Router in UPnP applications.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

14.4 Installing UPnP in Windows Example

This section shows how to install UPnP in Windows XP.

14.4.2 Installing UPnP in Windows XP

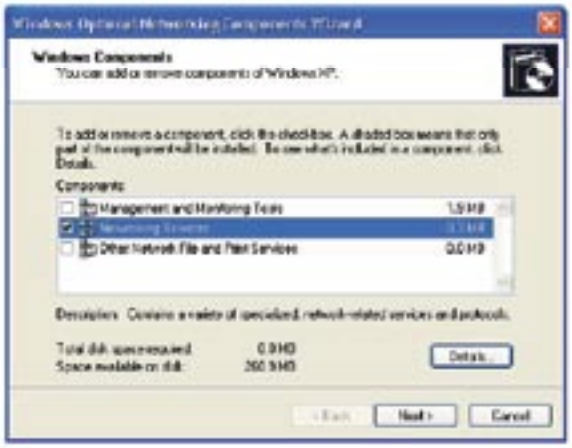
Follow the steps below to install UPnP in Windows XP.

Step 1. Click Start and Control Panel.

Step 2. Double-click Network Connections.

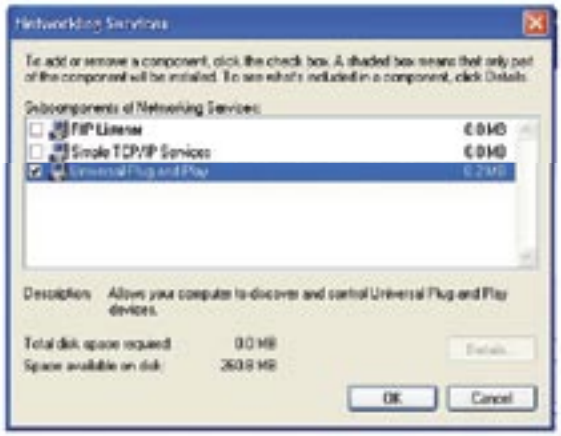
Step 3. In the Network Connections window, click Advanced in the main menu and select Optional Networking Components ....The Windows Optional Networking Components Wizard window displays.

Step 4. Select Networking Service in the Components selection box and click Details.



Step 5. In the Networking Services window, select the Universal Plug and Play check box.

Step 6. Click OK to go back to the Windows Optional Networking Component Wizard window and click Next.



14.5 Using UPnP in Windows XP Example

This section shows you how to use the UPnP feature in Windows XP. You must already have UPnP installed in Windows XP and UPnP activated on the WR1500 Wireless Router.

Make sure the computer is connected to a LAN port of the WR1500 Wireless Router. Turn on your computer and the WR1500 Wireless Router.

14.5.1 Auto-discover Your UPnP-enabled Network Device

Step 1. Click Start and Control Panel.

Double-click Network Connections. An icon displays under Internet Gateway.

Step 2. Right-click the icon and select Properties.

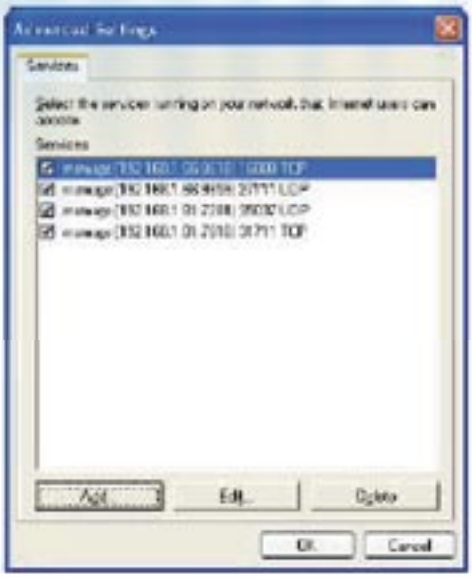
Step 3. In the Internet Connection Properties window, click Settings to see the port mappings that were automatically created.

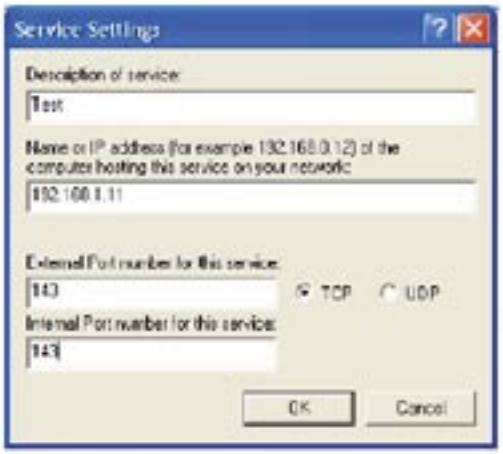
Internet Connection Properties
General
Connect to the Internet using:
Internet Connection
This connection allows you to connect to the Internet through a shared connection on another computer.
Settings...
Show icon in notification area when connected
OK
Cancel

Continued next page

14.5.1 Auto-discover Your UPnP-enabled Network Device - Continued

Step 4. You may edit or delete the port mappings or click Add to manually add port mappings.





When the UPnP-enabled device is disconnected from your computer, all port mappings will be deleted automatically.

Step 5. Select the Show icon in notification area.

Step 6. Double-click the icon to display your current Internet connection status.

D2D TECHNOLOGY

14.5.2 Web Configuration Utility Easy Access

With UPnP, you can access the web-based Web Configuration Utility on the WR1500 Wireless Router without finding out the IP address of the WR1500 Wireless Router first. This is helpful if you do not know the IP address of the WR1500 Wireless Router.

Follow the steps below to access the Web Configuration Utility.

Step 1. Click start and then Control Panel.

Step 2. Double-click Network Connections.

Step 3. Select My Network Places under Other Places.

Step 4. An icon with the description for each UPnP-enabled device displays under Local Network.

Step 5. Right-click the icon for your WR1500 Wireless Router and select Invoke. The Web Configuration Utility login screen displays.

Step 6. Right-click the icon for your WR1500 Wireless Router and select Properties. A properties window displays with basic information about the WR1500 Wireless Router. (Screen not shown)

Chapter 15: Logs Screens

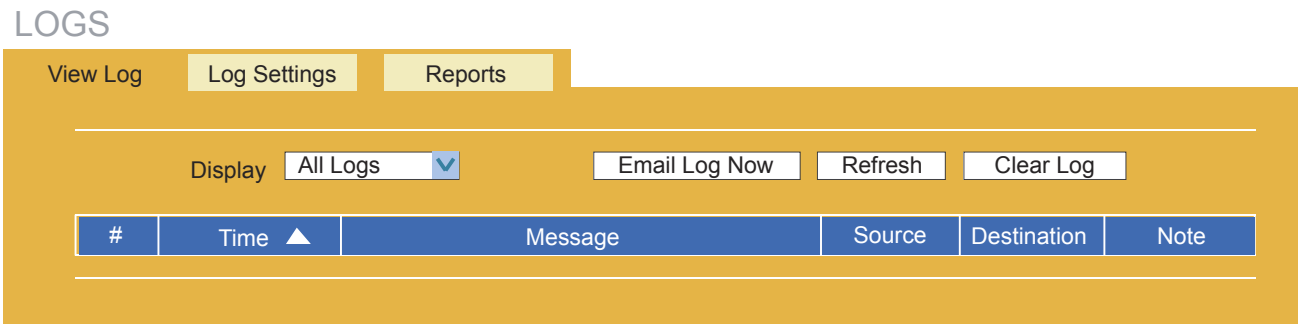
This chapter contains information about configuring general log settings and viewing the WR1500 Wireless Router's logs. Refer to the appendix for example log message explanations.

15.1 Using the View Log Screen

The Web Configuration Utility allows you to look at all of the WR1500 Wireless Router's logs in one location.

Click **ADVANCED** and then **LOGS** to open the View Log screen. Use the View Log screen to see the logs for the categories that you selected in the Log Settings screen (see section 15.2). Options include logs about system maintenance, system errors, access control, allowed or blocked web sites, blocked web features (such as ActiveX controls, Java and cookies), attacks (such as DoS) and IPSec.

You can view logs and alert messages in this page. Log entries in red indicate system error logs. Once the log entries are all used, the log will wrap around and the old logs will be deleted. Click a column heading to sort the entries. A triangle indicates the direction of the sort order.



The table on the following page describes the labels in the screen above.

15.1 Using the View Log Screen - Continued

The following table describes the labels in the screen on the proceeding page.

View Log

LABEL	DESCRIPTION
Display	Select a log category from the drop down list box to display logs within the selected category. To view all logs, select **All Logs.** The number of categories shown in the drop down list box depends on the selection in the **Log Settings** page.
Time	This field displays the time the log was recorded.
Message	This field states the reason for the log.
Source	This field lists the source IP address and the port number of the incoming packet.
Destination	This field lists the destination IP address and the port number of the incoming packet.
Notes	This field displays additional information about the log entry.
Email Log Now	Click **Email Log Now** to send the log screen to the e-mail address specified in the **Log Settings** page.
Refresh	Click **Refresh** to renew the log screen.
Clear Log	Click **Clear Log** to clear all the logs.

15.2 Configuring Log Settings

To change your WR1500 Wireless Router's log settings, click **ADVANCED, LOGS** and then the **Log Settings** tab. The screen appears as shown.

Use the Log Settings screen to configure to where the WR1500 Wireless Router is to send the logs; the schedule for when the WR1500 Wireless Router is to send the logs and which logs and/or immediate alerts the WR1500 Wireless Router is to send.

An alert is a type of log that warrants more serious attention. They include system errors, attacks (access control) and attempted access to blocked web sites or web sites with restricted web features such as cookies, Active X and so on. Some categories such as System Errors consist of both logs and alerts. You may differentiate them by their color in the View Log screen.

Alerts are displayed in red and logs are displayed in black.

15.2 Configuring Log Settings - Continued

LOGS

View Log | Log Settings | Reports

Address Info.

Mail Server (Outgoing SMTP Server Name or IP Address)
Mail Subject
Send Log to (E-mail Address)
Send Alerts to (E-mail Address)

Syslog Logging

Active
Syslog Server IP Address 0.0.0.0
Log Facility Local

Send Log

Log Schedule When Log is Full
Day for Sending Log Sunday
Time for Sending Log 0 (hour) 0 (minute)

Log	Send Immediate Alert
System Maintenance	System Errors
System Errors	Access Control
Access Control	Blocked Web Sites
TCP Reset	Blocked Java etc.
Packet Filter	Attacks
UPnP	
Forward Web Sites	
Blocked Web Sites	
Blocked Java etc.	
Attacks	
802.1X	

Apply Reset

The table on the following page describes the labels in the screen above.

15.2 Configuring Log Settings - Continued

The following table describes the labels in the screen on the proceeding page.

Log Settings

LABEL	DESCRIPTION
Address Info	
Mail Server	Enter the server name or the IP address of the mail server for the e-mail addresses specified below. If this field is left blank, logs and alert messages will not be sent via e-mail.
Mail Subject	Type a title that you want to be in the subject line of the log e-mail message that the WR1500 Wireless Router sends.
Send Log to	Logs are sent to the e-mail address specified in this field. If this field is left blank, logs will not be sent via e-mail.
Send Alerts to	Enter the e-mail address where the alert messages will be sent. Alerts include system errors, attacks and attempted access to blocked web sites. If this field is left blank, alert messages will not be sent via e-mail.
Syslog Logging	UNIX syslog sends a log to an external UNIX server used to store logs.
Active	Click **Active** to enable UNIX syslog.
Syslog Server IP Address	Enter the server name or the IP address of the syslog server that will log the CDR (Call Detail Record) and system messages.
Log Facility	Select the Local from the drop down list box. The log facility allows you to log the messages to different files in the syslog server. Refer to your UNIX manual for more information.
Send Log	
Log Schedule	This drop-down menu is used to configure the frequency of log messages being sent as E-mail: • **Daily** • **Weekly** • **Hourly** • **When the Log is Full** • **None.** If the **Weekly** or the **Daily** option is selected, specify a time of day when the E-mail should be sent. If the **Weekly** option is selected, then also specify which day of the week the E-mail should be sent. If the **When Log is Full** option is selected, an alert is sent when the log fills up. If you select **None,** no log messages are sent.
Day for Sending Log	This field is only available when you select **Weekly** in the **Log Schedule** field. Use the drop down list box to select which day of the week to send the logs.
Time for Sending Log	Enter the time of the day in 24-hour format (for example 23:00 equals 11:00 pm) to send the logs.
Log	Select the categories of logs that you want to record.
Send Immediate Alert	Select the categories of alerts for which you want the WR1500 Wireless Router to immediately send e-mail alerts.
Apply	Click **Apply** to save your changes back to the WR1500 Wireless Router.
Reset	Click **Reset** to begin configuring this screen afresh.

15.3 Configuring Reports

To change your WR1500 Wireless Router's log reports, click **ADVANCED, LOGS** and then the **Reports tab.** The screen appears as shown.

The Reports screen displays which computers on the LAN send and receive the most traffic, what kinds of traffic are used the most and which web sites are visited the most often. Use the Reports screen to view information about bandwidth usage :

> Web sites visited the most often.

> Number of times the most visited web sites were visited.

> The most-used protocols or service ports.

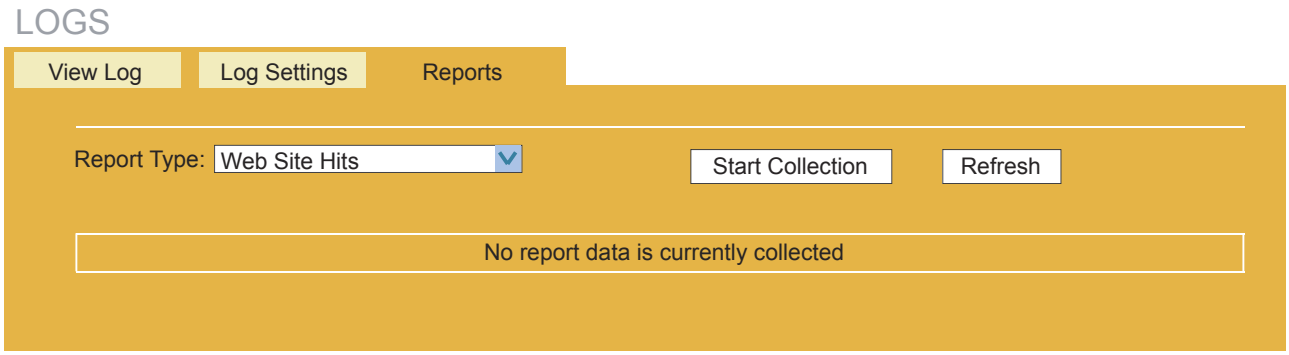
> The amount of traffic for the most used protocols or service ports.

> The LAN IP addresses to and/or from which the most traffic has been sent.

> How much traffic has been sent to and from the LAN IP addresses to and/or from which the most traffic has been sent.

The web site hit count may not be 100% accurate because sometimes when an individual web page loads, it may contain references to other web sites that also get counted as hits.

The WR1500 Wireless Router records web site hits by counting the HTTP GET packets. Many web sites include HTTP GET references to other web sites and the WR1500 Wireless Router may count these as hits, thus the web hit count is not (yet) 100% accurate.



Enabling the WR1500 Wireless Router's reporting function decreases the overall throughput by about 1 Mbps.

The table on the following page describes the labels in the screen above.

15.3 Configuring Reports - Continued

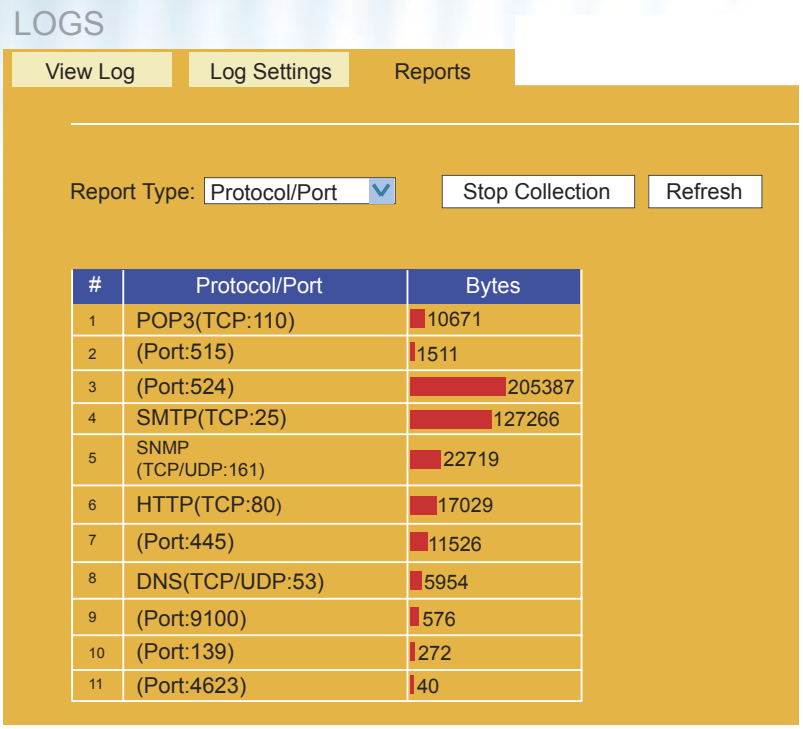
The following table describes the labels in the screen on the proceeding page.

Reports

LABEL	DESCRIPTION
Report Type	Use the drop-down list box to select the type of reports to display. **Web Site Hits** displays the web sites that have been visited the most often from the LAN and how many times they have been visited. **Protocol/Port** displays the protocols or service ports that have been used the most and the amount of traffic for the most used protocols or service ports. **LAN** IP **Address** displays the LAN IP addresses to and /or from which the most traffic has been sent and how much traffic has been sent to and from those IP addresses.
Start Collection/ Stop Collection	The button text shows **Start Collection** when the WR1500 Wireless Router is not recording report data and **Stop Collection** when the WR1500 Wireless Router is recording report data. Click **Start Collection** to have the WR1500 Wireless Router record report data. Click **Stop Collection** to halt the WR1500 Wireless Router from recording more data.
Refresh	Click **Refresh** to update the report display. The report also refreshes automatically when you close and reopen the screen.
#	This field displays the index number of an individual web site.
Web Site	**Web Site** displays the web site address(es) that have been visited the most often from the LAN.
Hits	**Hits** displays the total number of visits to each web site.

15.3.1 Viewing Protocol/Port

In the **Reports** screen, select **Protocol/Port** from the **Report Type** drop-down list box to have the WR1500 Wireless Router record and display which protocols or service ports have been used the most and the amount of traffic for the most used protocols or service ports.



The following table describes the labels in this screen.

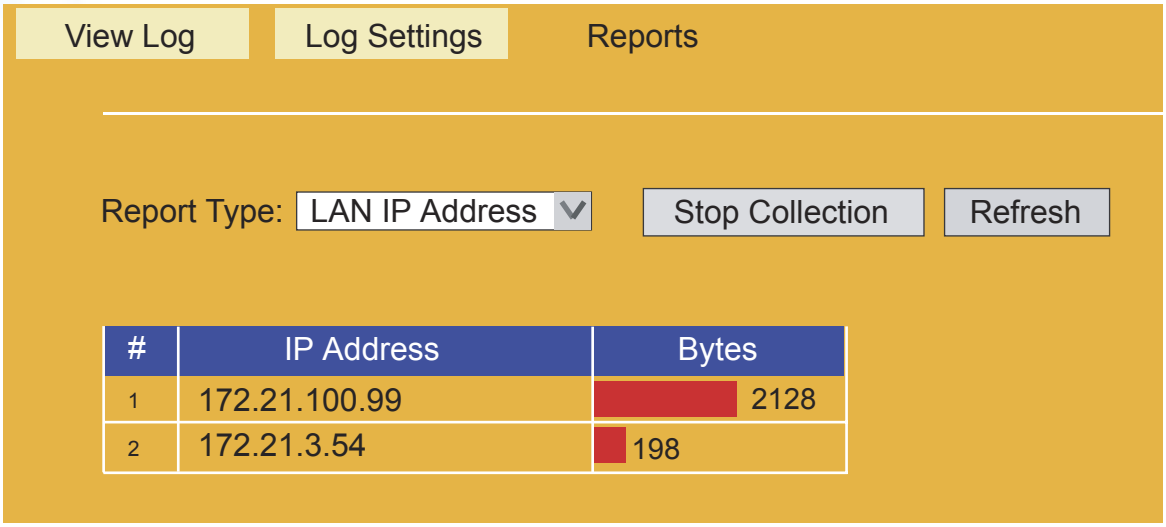
Protocol/Port Report

LABEL	DESCRIPTION
Protocol/Port	This column lists the protocols or service ports for which the most traffic has gone through the WR1500 Wireless Router. The protocols or service ports are listed in descending order with the most used protocol or service port listed first.
Start Collection/ Stop Collection	The button text shows **Start Collection** when the WR1500 Wireless Router is not recording report data and **Stop Collection** when the WR1500 Wireless Router is recording report data. Click **Start Collection** to have the WR1500 Wireless Router record report data. Click **Stop Collection** to halt the WR1500 Wireless Router from recording more data.
Refresh	Click **Refresh** to update the report display. The report also refreshes automatically when you close and reopen the screen.
Bytes	This column lists how much traffic has been sent and/or received for each protocol or service port. The measurement unit shown (bytes, Kbytes, Mbytes or Gbytes) varies with the amount of traffic for the particular protocol or service port. The count starts over at 0 if a protocol or port passes the bytes count limit (see *Table 15-6).*

15.3.2 Viewing LAN IP Address

In the **Reports** screen, select **LAN IP Address** from the Report Type drop-down list box to have the WR1500 Wireless Router record and display the LAN IP addresses that the most traffic has been sent to and/or from and how much traffic has been sent to and/or from those IP addresses.

Computers take turns using dynamically assigned LAN IP addresses. The WR1500 Wireless Router continues recording the bytes sent to or from a LAN IP address when it is assigned to a different computer.



LAN IP Address Report

LABEL	DESCRIPTION
Start Collection/ Stop Collection	The button text shows **Start Collection** when the WR1500 Wireless Router is not recording report data and **Stop Collection** when the WR1500 Wireless Router is recording report data. Click **Start Collection** to have the WR1500 Wireless Router record report data. Click **Stop Collection** to halt the WR1500 Wireless Router from recording more data.
Refresh	Click **Refresh** to update the report display. The report also refreshes automatically when you close and reopen the screen.
IP Address	This column lists the LAN IP addresses to and/or from which the most traffic has been sent. The LAN IP addresses are listed in descending order with the LAN IP address to and/or from which the most traffic was sent listed first.
Bytes	This column displays how much traffic has gone to and from the listed LAN IP addresses. The measurement unit shown (bytes, Kbytes, Mbytes or Gbytes) varies with the amount of traffic sent to and from the LAN IP address. The count starts over at 0 if the total traffic sent to and from a LAN IP passes the bytes count limit (see *Table 15-6).*

15.3.3 Reports Specifications

The following table lists detailed specifications on the reports feature.

Report Specifications

LABEL	DESCRIPTION
Number of web sites/protocols or ports/IP addresses listed:	20
Hit count limit:	Up to 2^{32} hits can be counted per web site. The count starts over at 0 if it passes four billion.
Bytes count limit:	Up to 2^{64} bytes can be counted per protocol/port or LAN IP address. The count starts over at 0 if it passes 2^{64} bytes.

Part VII

Maintenance

This part describes the Maintenance Web Configuration Utility screens.

Chapter 16: Maintenance

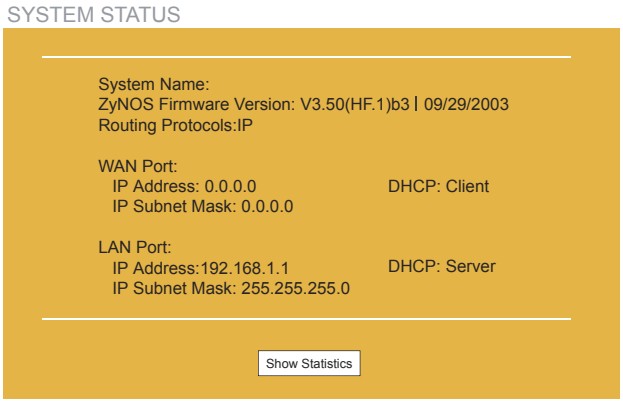
This chapter displays system information such as firmware, port IP addresses and port traffic statistics.

16.1 Maintenance Overview

The maintenance screens can help you view system information, upload new firmware, manage configuration and restart your WR1500 Wireless Router.

16.2 System Status Screen

Click **MAINTENANCE** to open the **System Status** screen, where you can use to monitor your WR1500 Wireless Router. Note that these fields are READ-ONLY and are meant to be used for diagnostic purposes.

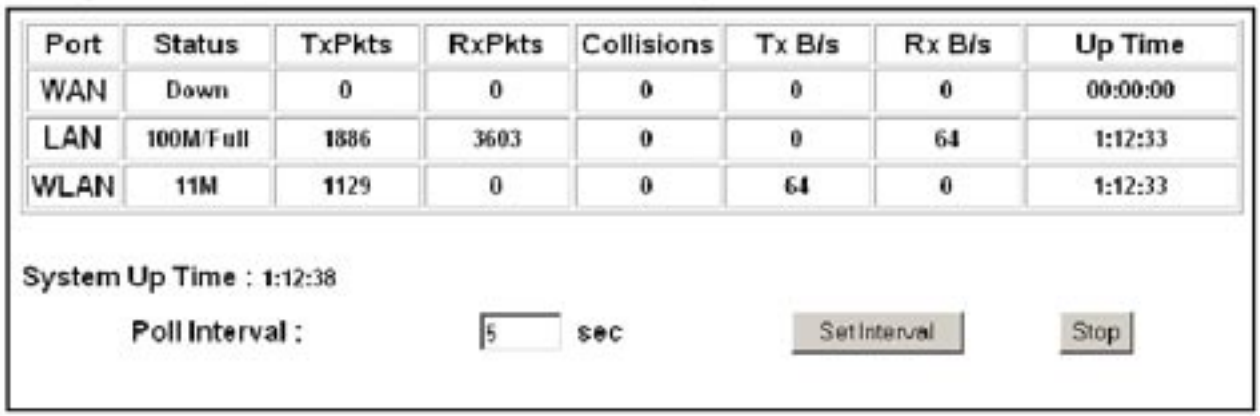


The following table describes the information in the **SYSTEM STATUS** screen:

LABEL	DESCRIPTION
System Name	This is the **System Name** you enter in the first Internet Access Wizard screen. It is for identification purposes.
Firmware Version	This is the firmware version and the date created.
Routing Protocols	This shows the routing protocol - **IP** for which the WR1500 Wireless Router is configured.
WAN Port	
IP Address	This is the WAN port IP address.
IP Subnet Mask	This is the WAN port subnet mask.
DHCP	This is the WAN port DHCP role - **Client** or **None.**
LAN Port	
IP Address	This is the LAN port IP address.
IP Subnet Mask	This is the LAN port subnet mask.
DHCP	This is the LAN port DHCP role - **Server, Client** or **None.**
Show Statistics	Click **Show Statistics** to see router performance statistics such as number of packets sent and number of packets received for each port.

16.2.1 System Statistics

Read-only information here includes port status and packet specific statistics. Also provided are "system up time" and "poll interval(s)". The Poll Interval field is configurable.



The following table describes the labels in this screen.

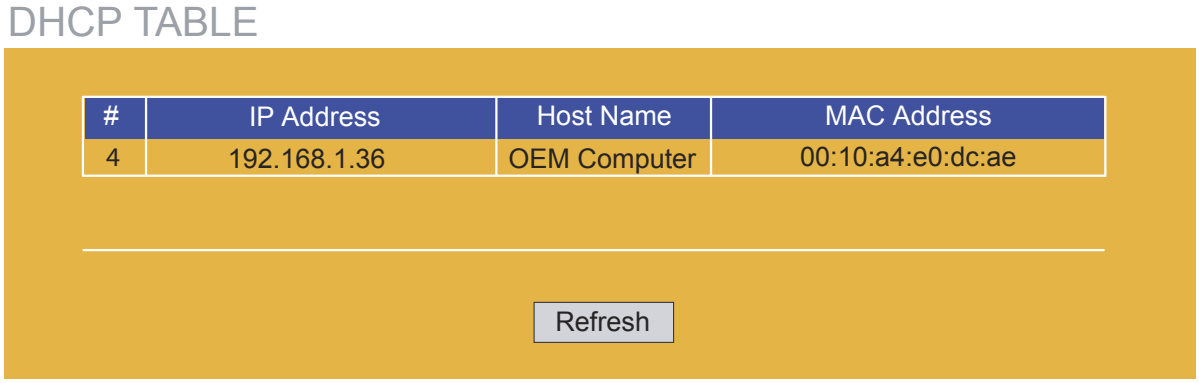
System Status: Show Statistics

LABEL	DESCRIPTION
Port	This is the LAN or WAN port.
Status	This shows the port speed and duplex setting if you are using Ethernet encapsulation for the Ethernet port. This shows the transmission speed only for wireless port.
TxPkts	This is the number of transmitted packets on this port.
RxPkts	This is the number of received packets on this port.
Collisions	This is the number of collisions on this port.
TxB/s	This shows the transmission speed in bytes per second on this port.
RxB/s	This shows the reception speed in bytes per second on this port.
Up Time	This is the total amount of time the line has been up.
System Up Time	This is the total time the WR1500 Wireless Router has been on.
Poll Interval	Enter the time interval for refreshing statistics.
Set Interval	Click this button to apply the new poll interval you entered above.
Stop	Click this button to stop refreshing statistics.

16.3 DHCP Table Screen

DHCP (Dynamic Host Configuration Protocol, RFC 2131 and RFC 2132) allows individual clients to obtain TCP/IP configuration at start-up from a server. You can configure the WR1500 Wireless Router as a DHCP server or disable it. When configured as a server, the WR1500 Wireless Router provides the TCP/IP configuration for the clients. If set to None, DHCP service will be disabled and you must have another DHCP server on your LAN, or else the computer must be manually configured.

Click **MAINTENANCE** and then **DHCP TABLE**. Read-only information here relates to your DHCP status. The DHCP table shows current DHCP client information (including IP Address, Host Name and MAC Address) of all network clients using the DHCP server.



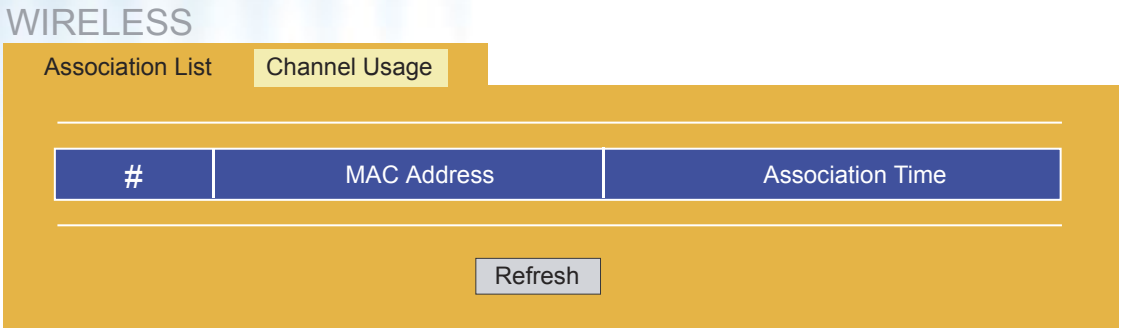
The following table describes the labels in this screen.

DHCP Table

LABEL	DESCRIPTION
#	This is the index number of an associated wireless station.
IP Address	This field displays the IP Address relative to the # field listed above.
Host Name	This field displays the computer host name.
MAC Address	The MAC (Media Access Control) or Ethernet address on a LAN (Local Area Network) is unique to your computer (six pairs of hexadecimal notation). A network interface card, such as an Ethernet adapter, has a hardwired address that is assigned at the factory. This address follows an industry standard that ensures no other adapter has a similar address.
Refresh	Click **Refresh** to reload the DHDCP table.

16.4 Wireless Screen

View the wireless stations that are currently associated to the WR1500 in the **Association List Screen**. Click **Maintenance**, and then **Wireless** to bring up the screen shown below.



The following table describes the labels in this screen.

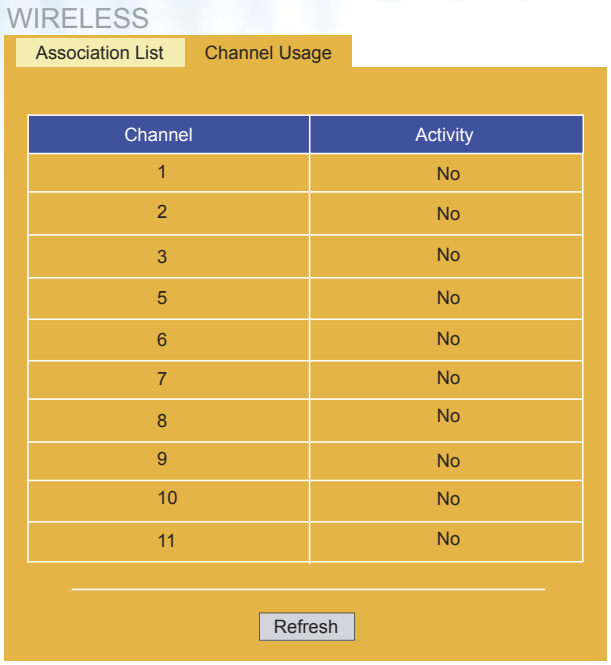
Association List

LABEL	DESCRIPTION
#	This is the index number of an associated wireless station.
MAC Address	This field displays the MAC address of an associated wireless station.
Association Time	This field displays the time a wireless station first associated with the WR1500 Wireless Router.
Refresh	Click **Refresh** to reload the screen.

16.4.1 Channel Usage

The Channel Usage screen displays whether a channel is used by another wireless network or not. If a channel is being used, you should select a channel removed from it by five channels to completely avoid overlap.

Click **MAINTENANCE**, **WIRELESS** and then the **Channel Usage tab** to display the screen shown next. Wait a moment while the WR1500 Wireless Router compiles the information.



The following table describes the labels in this screen.

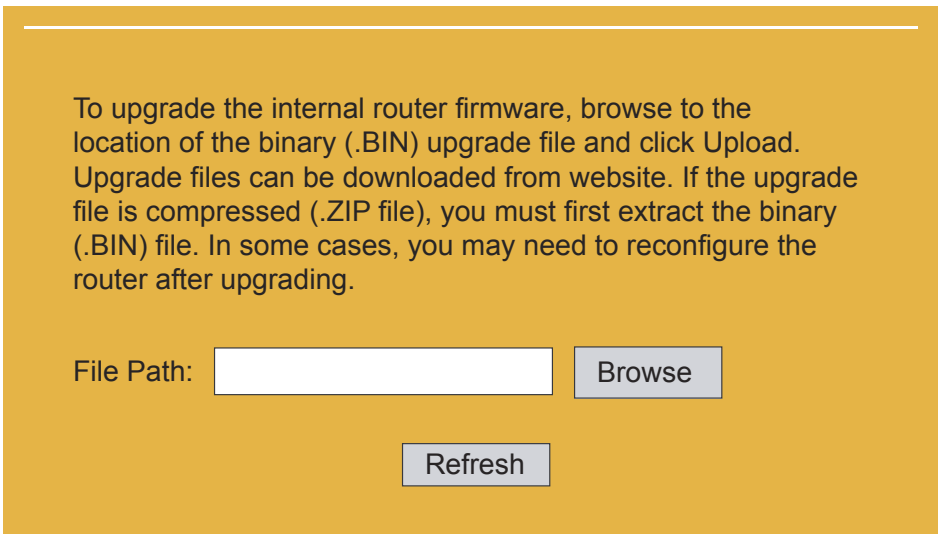
Channel Usage

LABEL	DESCRIPTION
SSID	This is the Service Set IDentification name of the AP in an infrastructure wireless network or wireless station in an Ad-Hoc wireless network. For our purposes, we define an Infrastructure network as a wireless network that uses an AP and an Ad-Hoc network (also known as Independent Basic Service Set (IBSS)) as one that doesn't. See the *Wireless Configuration and Roaming* chapter for more information on basic service sets (BSS) and extended service sets (ESS).
MAC Address	This field displays the MAC address of the AP in an Infrastructure wireless network. It is randomly generated (so ignore it) in an Ad-Hoc wireless network.
Channel	This is the index number of the channel currently used by the associated AP in an Infrastructure wireless network or wireless station in an Ad-Hoc wireless network.
Signal	This field displays the strength of the AP's signal. If you must choose a channel that's currently in use, choose one with low signal strength for minimum interference.
Network Mode	"Network mode" in this screen refers to your wireless LAN infrastructure (refer to the *Wireless LAN* chapter) and WEP setup. Network modes are: **Infrastructure** (same as an extended service set ESS)), **Infrastructure with WEP** (WEP encryption is enabled), **Ad-Hoc** (same as an independent basic service set IBSS)), or **Ad-Hoc with WEP.**
Refresh	Click Refresh to reload the screen.

16.5 F/W Upload Screen

Occasionally, we will make an updated version of firmware available for download. To check and see if a newer version of firmware is available for your WR1500, go to the following page on our web site: www.parkervision.com/downloads.htm Under the section for the WR1500 on that page, you will see a link for a firmware update for the WR1500 (if available). The upload process uses HTTP (Hypertext Transfer Protocol) and may take up to two minutes. After a successful upload, the system will reboot. See the Firmware and Configuration File Maintenance chapter for upgrading firmware using FTP/TFTP commands.

Click **MAINTENANCE**, and then the **FAV UPLOAD tab**. Follow the instructions in this screen to upload firmware to your WR1500 Wireless Router.


FIRMWARE UPLOAD
To upgrade the internal router firmware, browse to the location of the binary (.BIN) upgrade file and click Upload. Upgrade files can be downloaded from website. If the upgrade file is compressed (.ZIP file), you must first extract the binary (.BIN) file. In some cases, you may need to reconfigure the router after upgrading.
File Path:
Browse
Refresh

The following table describes the labels in this screen.

Firmware Upload

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse** ... to find it.
Browse...	Click **Browse...** to find the .bin file you want to upload. Remember that you must decompress compressed (.zip) files before you can upload them.
Upload	Click **Upload** to begin the upload process. This process may take up to two minutes.

Do not turn off the device while firmware upload is in progress!

After you see the Firmware Upload in Process screen, (see next page for this screen) wait two minutes before logging into the device again.

Continued on next page

16.5 F/W Upload Screen - Continued

FIRMWARE UPLOAD

Firmware Upload In Process

Warning!
Do Not Turn Off the Device.

Please wait for the device to finish restarting (SYS LED is on steady). This should take about two minutes.

To access the device after a successful firmware upload, you need to log in again. Check your new firmware version in the system status menu.

Wait two minutes before logging into the device again, after you see the above screen.

The WR1500 Wireless Router automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

After two minutes, log in again and check your new firmware version in the System Status screen.

If the upload was not successful, the following screen will appear. Click **Return** to go back to the **F/W Upload screen**.

FIRMWARE UPLOAD

Firmware upload error!

The uploaded file was not accepted by the router. Please return to the previous page and select a valid upgrade file. Click Help for more information.

Return

16.6 Configuration Screen

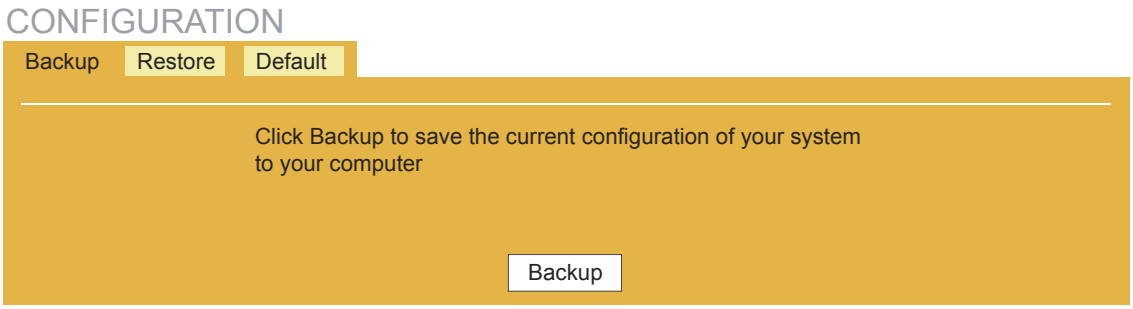
The Web Configuration Utility uses TFTP to transfer files. See the Firmware and Configuration File Maintenance chapter for transferring configuration files using FTP/TFTP commands.

Click **MAINTENANCE** and then the **Configuration tab**. Information related to backup configuration, restoring configuration and factory defaults appears as shown next.

16.6.1 Backup Configuration

Backup configuration allows you to backup (save) the current system (WR1500 Wireless Router) configuration to your computer. Backup is highly recommended once your WR1500 Wireless Router is functioning properly.

Click **Backup** to save your current WR1500 Wireless Router configuration to your computer.



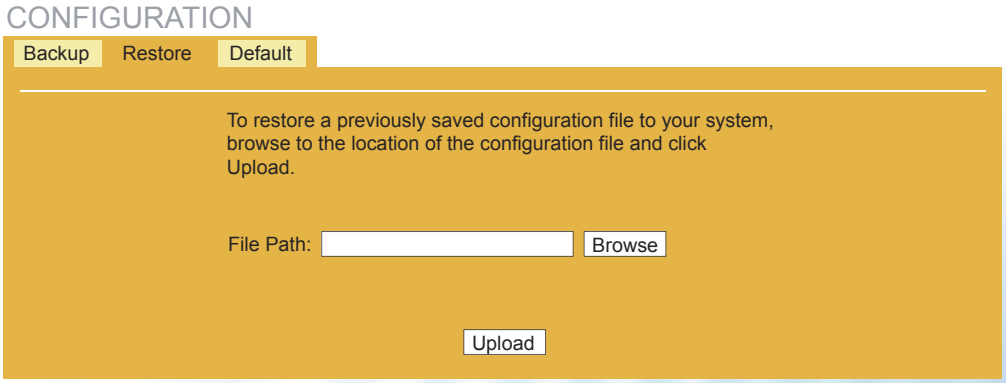
16.6.2 Restore Configuration

Restore configuration replaces your WR1500 Wireless Router's current configuration (content filters, firewall settings, etc.) with a previously saved configuration. Restore files (usually) have a .ROM extension, e.g., "WR1500 Wireless Router ROM". The system reboots automatically after the file transfer is complete and uses the configured values in the file.

WARNING! Do not interrupt the file transfer process as this may PERMANENTLY DAMAGE YOUR WR1500 WIRELESS ROUTER!

When the Restore Configuration process is complete, the WR1500 Wireless Router will automatically restart. Click the Restore tab to display the screen shown next.

The screen below is explained on the next page.



16.6.2 Restore Configuration - Continued

The following table describes the labels in the screen on the preceding page.

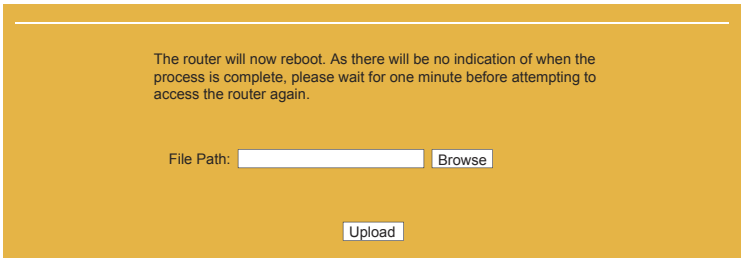
Restore Configuration

LABEL	DESCRIPTION
File Path	Type in the location of the file you want to upload in this field or click **Browse** ... to find it.
Browse...	Click **Browse...** to find the file you want to upload. Remember that you must decompress compressed (.ZIP) files before you can upload them.
Upload	Click **Upload** to begin the upload process.

Do not turn off the device while configuration file upload is in progress.

After you see a “configuration upload successful” screen, you must then wait one minute before logging into the WR1500 Wireless Router again.

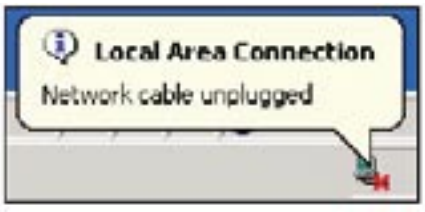
RESTORE CONFIGURATION


The router will now reboot. As there will be no indication of when the process is complete, please wait for one minute before attempting to access the router again.
File Path:
Browse
Upload

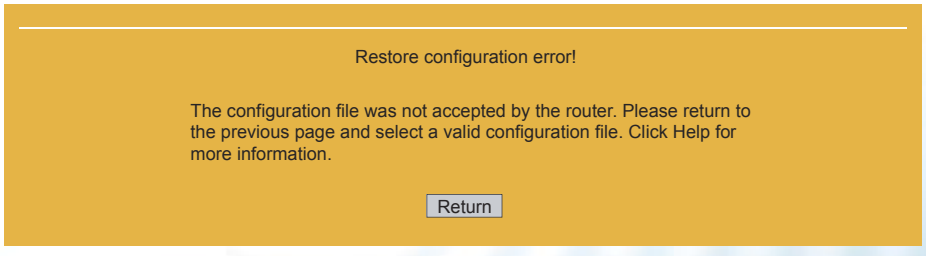
The WR1500 Wireless Router automatically restarts in this time causing a temporary network disconnect. In some operating systems, you may see the following icon on your desktop.

If you uploaded the default configuration file you may need to change the IP address of your computer to be in the same subnet as that of the default WR1500 Wireless Router IP address (192.168.1.1). See the appendix for details on how to set up your computer’s IP address.

If the upload was not successful, the following screen will appear. Click **Return** to go back to the **Configuration screen.**



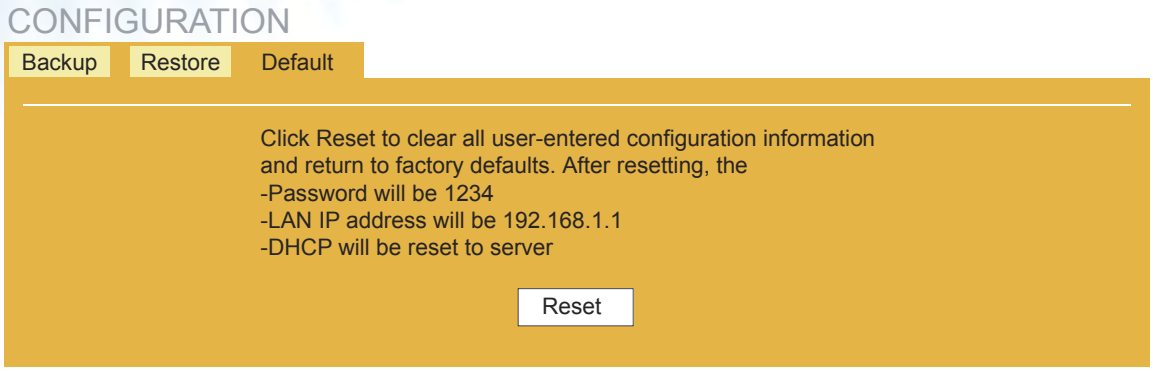
RESTORE CONFIGURATION


Restore configuration error!
The configuration file was not accepted by the router. Please return to the previous page and select a valid configuration file. Click Help for more information.
Return

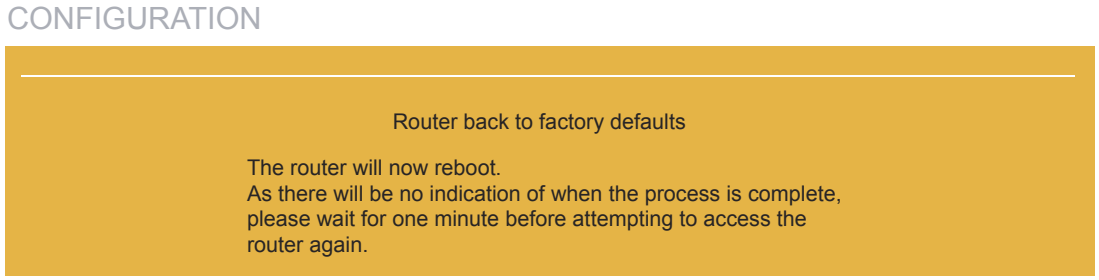
16.6.3 Back to Factory Defaults

Clicking the **Reset** button in this section clears all user-entered configuration information and returns the WR1500 Wireless Router to its factory defaults as shown on the screen. This will erase all configurations that you have applied.

Click the **Default tab** to display the screen shown next.



Clicking the **Reset button** will cause the following screen to be displayed:


CONFIGURATION
Router back to factory defaults
The router will now reboot.
As there will be no indication of when the process is complete,
please wait for one minute before attempting to access the
router again.

You can also press the **RESET button** on the side panel to reset the factory defaults of your WR1500 Wireless Router. Refer to the Resetting the WR1500 Wireless Router section for more information on the RESET button.

Part VIII

SMT Getting Started Menus

This part introduces the SMT (System Management Terminal) and discusses the “Getting Started” SMT menus.

See the Web Configuration Utility parts of this guide for background information on features configurable by Web Configuration Utility and SMT.

Chapter 17: Introducing the SMT

This chapter describes how to access the SMT and provides an overview of its menus.

17.1 Connect to your WR1500 Wireless Router Using Telnet

The following procedure details how to telnet into your WR1500 Wireless Router.

Step 1. Make sure your computer IP address and the WR1500 Wireless Router IP address are on the same subnet. Refer to the Setting Up Your Computer IP Address appendix.

Step 2. In Windows, click Start (usually in the bottom left corner), Run and then type “telnet 192.168.1.1” (the default IP address) and click OK.

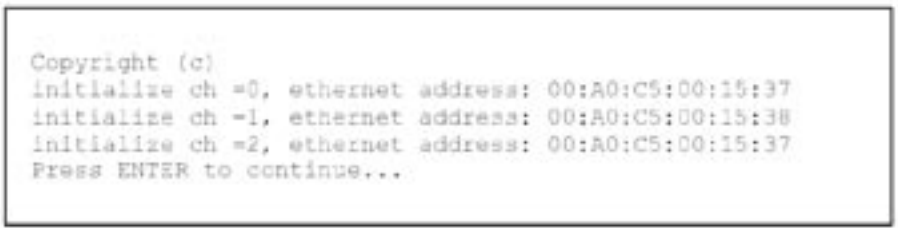
Step 3. For your first login, enter 1234 in the Password field. As you type the password, the screen displays an “x” for each character you type.

Step 4. After entering the password you will see the main menu.

Please note that if there is no activity for longer than five minutes (default timeout period) after you log in, your WR1500 Wireless Router will automatically log you out.

17.2.1 Initial Screen

When you turn on your WR1500 Wireless Router, it performs several internal tests as well as line initialization. After the initialization, the WR1500 Wireless Router asks you to press **[ENTER]** to continue, as shown.


Copyright (c)
initialize ch =0, ethernet address: 00:A0:C5:00:15:37
initialize ch =1, ethernet address: 00:A0:C5:00:15:38
initialize ch =2, ethernet address: 00:A0:C5:00:15:37
Press ENTER to continue...

17.2.2 Entering Password

The login screen appears after you press [ENTER], prompting you to enter the password, as shown next.

For your first login, enter the default password “1234”. As you type the password, the screen displays an “x” for each character you type.

17.3 Changing the System Password

Change the WR1500 Wireless Router default password by following the steps shown next.

Step 1. Enter 23 in the main menu to open Menu 23 - System Security.

Step 2. Enter 1 to display Menu 23.1 - System Security - Change Password as shown next.

Step 3. Type your existing system password in the Old Password field, for example “1234”, and press [ENTER].

Menu 23.1 - System Security - Change Password
Old Password= ****
New Password= ?
Retype to confirm= ?
Enter here to CONFIRM or ESC to CANCEL:

Step 4. Type your new system password in the New Password field (up to 30 characters), and press [ENTER].

Step 5. Re-type your new system password in the Retype to confirm field for confirmation and press [ENTER].

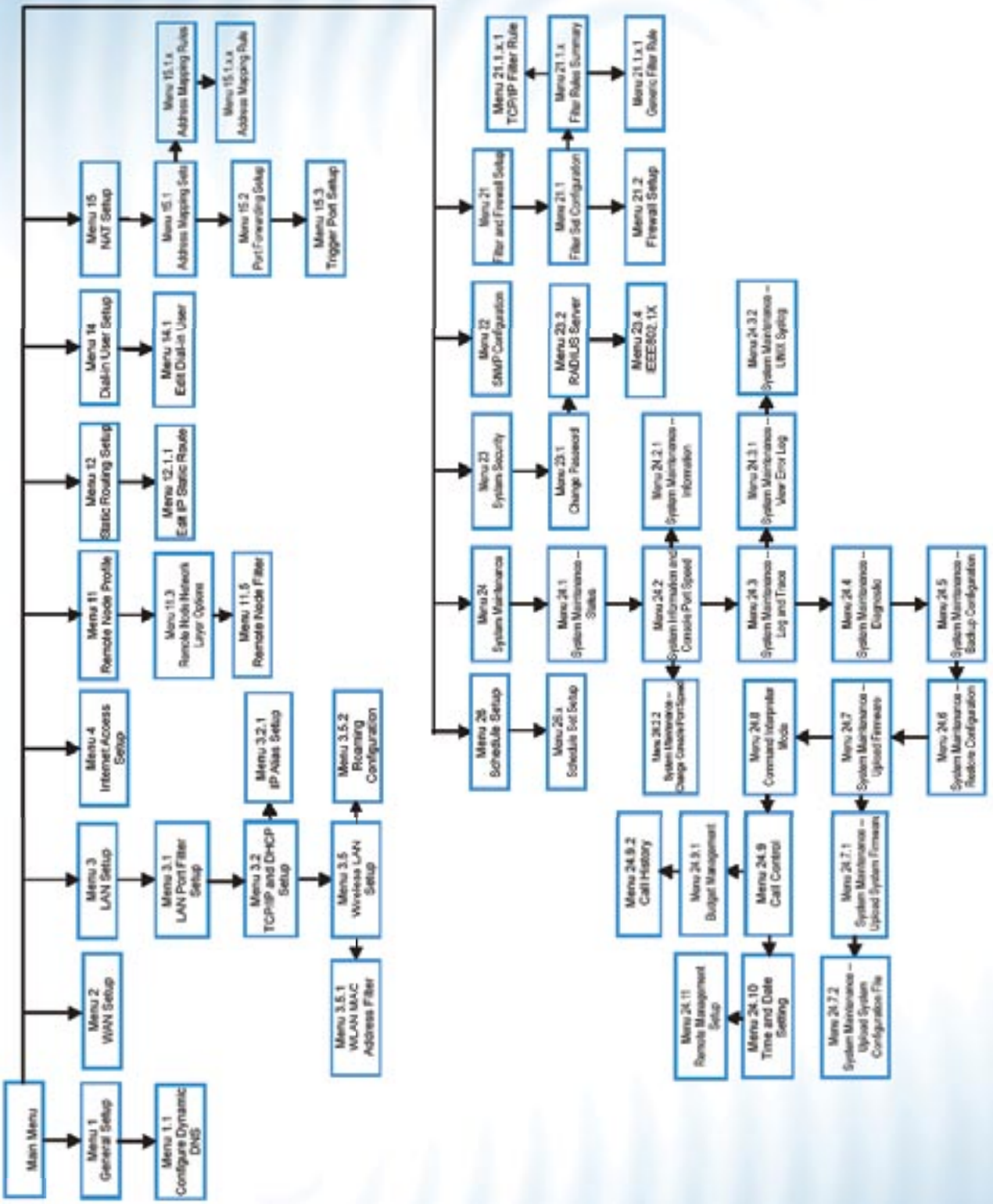
Note that as you type a password, the screen displays an asterisk “*” for each character you type.

17.4 WR1500 Wireless Router SMT Menu Overview Example

We use the WR1500 Wireless Router v.2 SMT menus in this guide as an example. The SMT menus for your model may vary slightly.

The diagram on the following page gives you an example overview of the various SMT menu screens for your WR1500 Wireless Router B-2000 v.2.

17.4 WR1500 Wireless Router SMT Menu Overview Example - Continued


Main Menu
Menu 1 General Setup
Menu 1.1 Configure Dynamic DNS
Menu 2 WAN Setup
Menu 3 LAN Setup
Menu 3.1 LAN Port Filter Setup
Menu 3.2 TCP/IP and DHCP Setup
Menu 3.2.1 IP Alias Setup
Menu 3.5 Wireless LAN Setup
Menu 3.5.1 WLAN MAC Address Filter
Menu 3.5.2 Roaming Configuration
Menu 4 Internet Access Setup
Menu 11 Remote Node Profile
Menu 11.3 Remote Node Network Layer Options
Menu 11.6 Remote Node Filter
Menu 12 Static Routing Setup
Menu 12.1.1 Edit IP Static Route
Menu 14 Dial-in User Setup
Menu 14.1 Edit Dial-in User
Menu 15 NAT Setup
Menu 15.1 Address Mapping Sets
Menu 15.1.x Address Mapping Rule
Menu 15.1.x.x Address Mapping Rule
Menu 15.2 Port Forwarding Setup
Menu 15.3 Trigger Port Setup
Menu 21 Filter and Firewall Setup
Menu 21.1 Filter Set Configuration
Menu 21.1.x.1 TCP/IP Filter Rule
Menu 21.1.x Filter Rules Summary
Menu 21.1.x.1 Generic Filter Rule
Menu 21.2 Firewall Setup
Menu 23 System Security
Menu 23.1 Change Password
Menu 23.2 RADIUS Server
Menu 23.4 IEEE802.1X
Menu 24 System Maintenance
Menu 24.1 System Maintenance – Status
Menu 24.2 System Information and Console Port Speed
Menu 24.2.1 System Maintenance – Information
Menu 24.2.2 System Maintenance – Change Console Port Speed
Menu 24.3 System Maintenance – Log and Trace
Menu 24.3.1 System Maintenance – View Error Log
Menu 24.3.2 System Maintenance – Unix Syslog
Menu 24.4 System Maintenance – Diagnostic
Menu 24.5 System Maintenance – Backup Configuration
Menu 24.6 System Maintenance – Restore Configuration
Menu 24.7 System Maintenance – Upload Firmware
Menu 24.7.1 System Maintenance – Upload System Firmware
Menu 24.7.2 System Maintenance – Upload System Configuration File
Menu 24.8 Command Interpreter Mode
Menu 24.9 Call Control
Menu 24.9.1 Budget Management
Menu 24.9.2 Call History
Menu 24.10 Time and Date Setting
Menu 24.11 Remote Management Setup
Menu 26 Schedule Setup
Menu 26.x Schedule Set Setup

D2D TECHNOLOGY

17.5 Navigating the SMT Interface

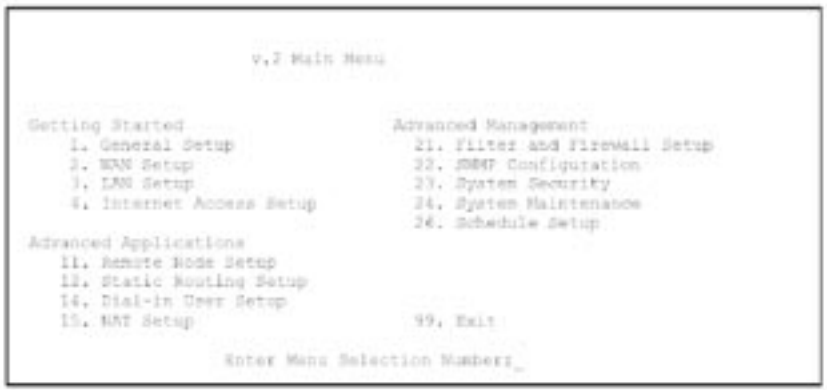
Several operations that you should be familiar with before you attempt to modify the configuration are listed in the table below.

Main Menu Commands

OPERATION	KEYSTROKE	DESCRIPTION
Move down to another menu	[ENTER]	To move forward to a submenu, type in the number of the desired submenu and press [ENTER].
Move up to a previous menu	[ESC]	Press [ESC] to move back to the previous menu.
Move to a "hidden" menu	Press [SPACE BAR] to change No to **Yes** then press [ENTER].	Fields beginning with "Edit" lead to hidden menus and have a default setting of No. Press [SPACE BAR] once to change No to **Yes,** then press [ENTER] to go to the "hidden" menu.
Move the cursor	[ENTER] or [UP]/ [DOWN] arrow keys.	Within a menu, press [ENTER] to move to the next field. You can also use the [UP]/[DOWN] arrow keys to move to the previous and the next field, respectively.
Entering information	Type in or press [SPACE BAR], then press [ENTER].	You need to fill in two types of fields. The first requires you to type in the appropriate information. The second allows you to cycle through the available choices by pressing [SPACE BAR].
Required fields	<?> or **ChangeMe**	All fields with the symbol <?> must be filled in order to be able to save the new configuration. All fields with **ChangeMe** must not be left blank in order to be able to save the new configuration.
N/A fields	<N/A>	Some of the fields in the SMT will show a <N/A>. This symbol refers to an option that is Not Applicable.
Save your configuration	[ENTER]	Save your configuration by pressing [ENTER] at the message "Press ENTER to confirm or ESC to cancel". Saving the data on the screen will take you, in most cases to the previous menu.
Exit the SMT	Type 99, then press [ENTER].	Type 99 at the main menu prompt and press [ENTER] to exit the SMT interface.

After you enter the password, the SMT displays the main menu, as shown on the next page.

17.5 Navigating the SMT Interface - Continued



17.5.1 System Management Terminal Interface Summary

Main Menu Summary

#	MENU TITLE	DESCRIPTION
1	General Setup	Use this menu to set up your general information.
2	WAN Setup	Use this menu to set up your WAN connection.
3	LAN Setup	Use this menu to set up your LAN and WLAN connection.
4	Internet Access Setup	A quick and easy way to set up an Internet connection.
11	Remote Node Setup	Use this menu to set up the Remote Node for LAN-to-LAN connection, including Internet connection.
12	Static Routing Setup	Use this menu to set up static routes.
14	Dial-in User Setup	Use this menu to set up local user profiles on the WR1500 Wireless Router.
15	NAT Setup	Use this menu to specify inside servers when NAT is enabled.
21	Filter and Firewall Setup	Use this menu to set up filters and firewall to provide security, etc.
22	SNMP Configuration	Use this menu to set up SNMP related parameters.
23	System Security	Use this menu to change your password and set up wireless security.
24	System Maintenance	This menu provides system status, diagnostics, software upload, etc.
26	Schedule Setup	Use this menu to schedule outgoing calls.
99	Exit	Use this to exit from SMT and return to a blank screen.

Chapter 18:
General and WAN Setup

The chapter shews you the information on general setup and how to configure the WAN.

18.1 General Setup

Menu 1 - General Setup contains administrative and system-related information (shown next). The System Name field is for identification purposes. However, because some ISPs check this name you should enter your computer's "Computer Name".
The Domain Name entry is what is propagated to the DHCP clients on the LAN. If you leave this blank, the domain name obtained by DHCP from the ISP is used. While you must enter the host name (System Name) on each individual computer, the domain name can be assigned from the WR1500 Wireless Router via DHCP.

18.1.1 Dynamic DNS

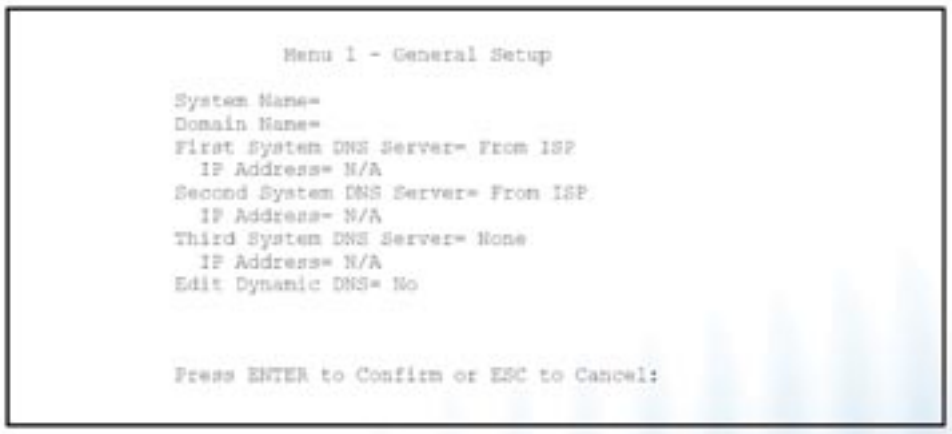
To use this service, you must register with the Dynamic DNS service provider. The Dynamic DNS service provider will give you a password or key. The WR1500 Wireless Router supports www.dyndns.org. You can apply to this service provider for Dynamic DNS service.

DYNDNS Wildcard

Enabling the wildcard feature for your host causes *.yourhost.dyndns.org to be aliased to the same IP address as yourhost.dyndns.org. This feature is useful if you want to be able to use, for example, www.yourhost.dyndns.org and still reach your hostname.

18.1.2 Procedure To Configure Menu 1

Step 1. Enter 1 in the Main Menu to open Menu 1 - General Setup as shown next.


Menu 1 - General Setup
System Name=
Domain Name=
First System DNS Server= From ISP
IP Address= N/A
Second System DNS Server= From ISP
IP Address= N/A
Third System DNS Server= None
IP Address= N/A
Edit Dynamic DNS= No
Press ENTER to Confirm or ESC to Cancel:

18.1.2 Procedure To Configure Menu 1 - Continued

Step 2. Fill in the required fields. Refer to the table shown next for more information about these fields.

Menu 1 General Setup

FIELD	DESCRIPTION	EXAMPLE
System Name	Choose a descriptive name for identification purposes. This name can be up to 30 alphanumeric characters long. Spaces are not allowed, but dashes"-" and underscores "_" are accepted.	**WR1500 Wireless Router**
Domain Name	Enter the domain name (if you know it) here. If you leave this field blank, the ISP may assign a domain name via DHCP. You can go to menu 24.8 and type "sys domainname" to see the current domain name used by your gateway. If you want to clear this field just press the [SPACE BAR]. The domain name entered by you is given priority over the ISP assigned domain name.	**parkervision.com**
First System DNS Server Second System DNS Server Third System DNS Server	Press [SPACE BAR] to select **From ISP, User Defined** or **None** and press [ENTER].	**From ISP**
IP Address	Enter the IP addresses of the DNS servers. This field is available when you select User-Defined in the field above.	**N/A**
Edit Dynamic DNS	Press [SPACE BAR] to select **Yes** and press [ENTER] to configure **Menu 1.1 - Configure Dynamic DNS** (discussed next).	**No**
When you have completed this menu, press [ENTER] at the prompt "Press ENTER to Confirm..." to save your configuration, or press [ESC] at any time to cancel.		

18.1.3 Procedure to Configure Dynamic DNS

If you have a private WAN IP address, then you cannot use Dynamic DNS.

Step 1. To configure Dynamic DNS, go to **Menu 1 - General Setup** and select **Yes** in the **Edit Dynamic DNS** field. Press [ENTER] to display Menu 1.1— Configure Dynamic DNS as shown on the next page.

18.1.3 Procedure to Configure Dynamic DNS - Continued

The following table describes the fields in this menu.

Menu 1.1 Configure Dynamic DNS

FIELD	DESCRIPTION	EXAMPLE
Service Provider	This is the name of your Dynamic DNS service provider.	WWW.DynDNS.ORG (default)
Active	Press [SPACE BAR] to select **Yes** and then press [ENTER] to make dynamic DNS active.	**Yes**
DDNS Type	Press [SPACE BAR] and then [ENTER] to select **DynamicDNS** if you have a dynamic IP address(es). Select **StaticDNS** if you have a static IP address(s). Select **CustomDNS** to have dyns.org provide DNS service for a domain name that you already have from a source other than dyndns.org.	**DynamicDNS** (default)
Host1-3	Enter your host name(s) in the fields provided. You can specify up to two host names separated by a comma in each field.	me.dyndns.org
USER	Enter your user name.	
Password	Enter the password assigned to you.	
Enable Wildcard	Your WR1500 Wireless Router supports DYNDNS wildcard. Press [SPACE BAR] and then [ENTER] to select **Yes** or **No** This field is **N/A** when you choose DDNS client as your service provider.	**No**
Offline	This field is only available when **CustomDNS** is selected in the **DDNS Type** field. Press [SPACE BAR] and then [ENTER] to select **Yes.** When **Yes** is selected, traffic is redirected to a URL that you have previously specified (see www.dvndns.org for details).	**Yes**
EUpdate IP Address: You can select **Yes** in either the **Use Server Detected IP** field (recommended) or the **User Specified IP Addr** field, but not both. With the **Use Server Detected IP** and **User Specified IP Addr** fields both set to **No,** the DDNS server automatically updates the IP address of the host name(s) with the WR1500 Wireless Router's WAN IP address. DDNS does not work with a private IP address. When both fields are set to **No,** the WR1500 Wireless Router must have a public WAN IP address in order for DDNS to work.		

Continued on next page

18.1.3 Procedure to Configure Dynamic DNS - Continued

Menu 1.1 Configure Dynamic DNS - Continued

FIELD	DESCRIPTION	EXAMPLE
Use Server Detected IP	Press [SPACE BAR] to select **Yes** and then press [ENTER] to have the DDNS server automatically update the IP address of the host name(s) with the public IP address that the WR1500 Wireless Router uses or is behind. You can set this field to **Yes** whether the IP address is public or private, static or dynamic.	**Yes**
User Specified IP Address	Press [SPACE BAR] to select **Yes** and then press [ENTER] to update the IP address of the host name(s) to the IP address specified below. Only select **Yes** if the WR1500 Wireless Router uses or is behind a static public IP address.	**No**
IP Address	Enter the static public IP address if you select **Yes** in the **User Specified IP Addr** field.	**N/A**
When you have completed this menu, press [ENTER] at the prompt "Press ENTER to Confirm..." to save your configuration, or press [ESC] at any time to cancel.		

18.2 WAN Setup

The MAC address field allows users to configure the WAN port's MAC address by either using the factory default or cloning the MAC address from a computer on your LAN. Once it is successfully configured, the address will be copied to the rom file. It will not change unless you change the setting or upload a different rom file.

ParkerVision recommends you clone the MAC address from a workstation on your LAN even if your ISP does not require MAC address authentication.

From the main menu, enter 2 to display Menu 2-WAN Setup screen as shown.

The table on the following page describes the fields in this menu.

18.2 WAN Setup - Continued

The table below describes the fields in the menu on the previous page.

FIELD	DESCRIPTION	EXAMPLE
MAC Address		
Assigned By	Press [SPACE BAR] to select **Factory default** and press [ENTER] to use the factory assigned MAC address. Select **IP address attached on LAN** and enter the IP address in the **IP Address** field below to clone the MAC address of the computer on the Ethernet.	**Factory default**
IP Address	Enter the IP address of the computer whose MAC address you are cloning. This field is available if you select **IP address attached on LAN** in the **Assigned By** field.	**N/A**
When you have completed this menu, press [ENTER] at the prompt “Press ENTER to Confirm...” to save your configuration, or press [ESC] at any time to cancel.		

Chapter 19:
LAN Setup

This chapter shows you how to configure the LAN on your WR1500 Wireless Router.

19.1 LAN Setup

This section describes how to configure the Ethernet using Menu 3 - LAN Setup. From the main menu, enter 3 to display menu 3.

Detailed explanation about the LAN Setup screens is given in the next chapter.

19.1.1 General Ethernet Port Filter Setup

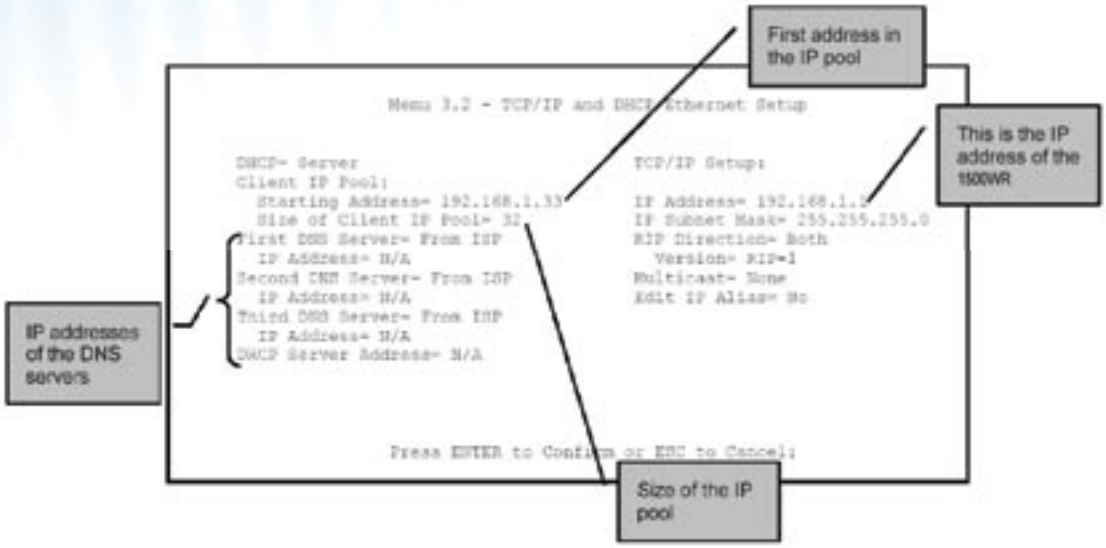
This menu allows you to specify filter set(s) that you wish to apply to the Ethernet traffic. You seldom need to filter Ethernet traffic; however, the filter sets may be useful to block certain packets, reduce traffic and prevent security breaches.

If you need to define filters, please read the Filter Set Configuration chapter first, then return to this menu to define the filter sets.

19.2 TCP/IP Ethernet and DHCP Setup

Use menu 3.2 to configure your WR1500 Wireless Router for TCP/IP.

To edit menu 3.2, enter 3 from the main menu to display Menu 3-Ethernet Setup. When menu 3 appears, press 2 and press [ENTER] to display Menu 3.2-TCP/IP and DHCP Ethernet Setup, as shown next:



Follow the instructions in the table on the following page to configure the DHCP fields.

19.2 TCP/IP Ethernet and DHCP Setup - Continued

Follow the instructions in the table below to configure the DHCP fields.

DHCP Ethernet Setup

FIELD	DESCRIPTION	EXAMPLE
DHCP	If set to **Server,** your WR1500 Wireless Router can assign IP addresses, an IP default gateway and DNS servers to Windows 95, Windows NT and other systems that support the DHCP client. If set to **None,** the DHCP server will be disabled. If set to **Relay,** the WR1500 Wireless Router acts as a surrogate DHCP server and relays DHCP requests and responses between the remote server and the clients. Enter the IP address of the actual, remote DHCP server in the Remote DHCP Server in this case. When DHCP is used, the following items need to be set:	**Server** (default)
Starting Address	This field specifies the first of the contiguous addresses in the IP address pool.	**192.168.1.33**
Size of Client IP Pool	This field specifies the size or count of the IP address pool.	**8**
First DNS Server Second DNS Server Third DNS Server	Press [SPACE BAR] to select **From ISP, User Defined, DNS Relay** or **None** and press [ENTER]. The DNS servers are passed to the DHCP clients along with the IP address and the subnet mask.	**From ISP**
IP Address	Enter the IP addresses of the DNS servers. This field is available when you select User-Defined in the field above.	**N/A**
DHCP Server Address	If **Relay** is selected in the **DHCP** field above then enter the IP address of the actual remote DHCP server here.	

Follow the instructions in the following table to configure TCP/IP parameters for the Ethernet port.

TCP/IP Ethernet Setup

FIELD	DESCRIPTION	EXAMPLE
TCP/IP Setup		
IP Address	Enter the (LAN) IP address of your WR1500 Wireless Router in dotted decimal notation	192.168.1.1
IP Subnet Mask	Your WR1500 Wireless Router will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the WR1500 Wireless Router.	255.255.255.0
RIP Direction	Press [SPACE BAR] to select the RIP direction. Choices are **Both, In Only, Out Only** or **None.**	**Both**

Continued on the next page

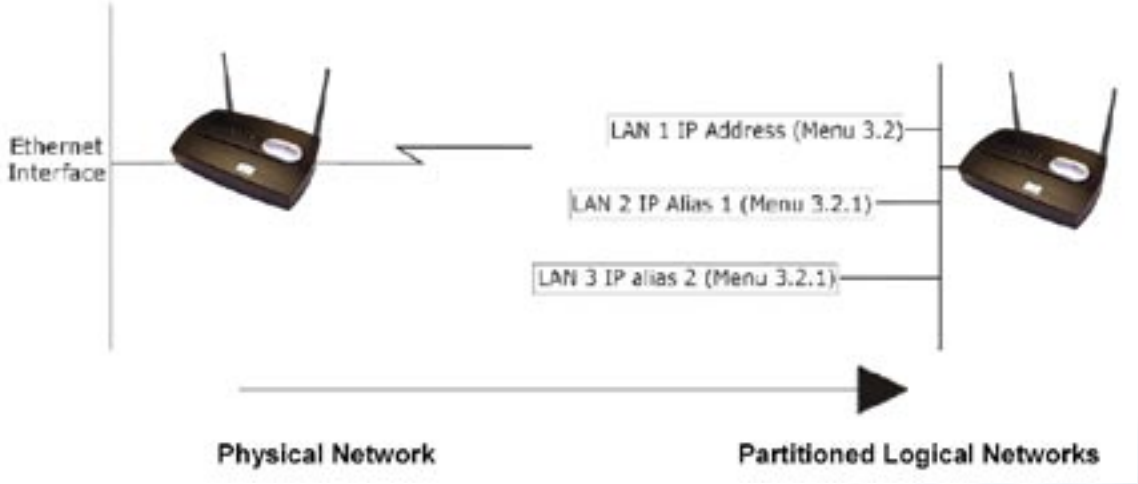
19.2 TCP/IP Ethernet and DHCP Setup - Continued

TCP/IP Ethernet Setup - Continued

FIELD	DESCRIPTION	EXAMPLE
Version	Press [SPACE BAR] to select the RIP version. Choices are RIP-1, RIP-2B or RIP-2M.	RIP-1
Multicast	IGMP (Internet Group Multicast Protocol) is a session-layer protocol used to establish membership in a Multicast group. The WR1500 Wireless Router supports both IGMP version 1(IGMP-v1) and version 2 (IGMP-v2). Press the [SPACE BAR] to enable IP Multicasting or select None to disable it.	None
Edit IP Alias	The WR1500 Wireless Router supports three logical LAN interfaces via its single physical Ethernet interface with the WR1500 Wireless Router itself as the gateway for each LAN network. Press [SPACE BAR] to select Yes and press [ENTER] to go to menu 3.2.1.	No
When you have completed this menu, press [ENTER] at the prompt “Press ENTER to Confirm...” to save your configuration, or press [ESC] at any time to cancel.		

19.3 IP Alias

IP Alias allows you to partition a physical network into different logical networks over the same Ethernet interface. The WR1500 Wireless Router supports three logical LAN interfaces via its single physical Ethernet interface with the WR1500 Wireless Router itself as the gateway for each LAN network.


Ethernet Interface
LAN 1 IP Address (Menu 3.2)
LAN 2 IP Alias 1 (Menu 3.2.1)
LAN 3 IP alias 2 (Menu 3.2.1)
Physical Network
Partitioned Logical Networks

Use menu 3.2.1 to configure IP Alias on your WR1500 Wireless Router.

19.3.1 IP Alias Setup

Use menu 3.2 to configure the first network. Move the cursor to Edit IP Alias field and press [SPACE BAR] to choose Yes and press [ENTER] to configure the second and third network.

```
                Menu 3.2 - TCP/IP and DHCP Ethernet Setup

DHCP= Server                          TCP/IP Setup:
Client IP Pool:                       IP Address= 192.168.1.1
  Starting Address= 192.168.1.33      IP Subnet Mask= 255.255.255.0
  Size of Client IP Pool= 32          RIP Direction= Both
First DNS Server= From ISP              Version= RIP-1
  IP Address= N/A                     Multicast= None
Second DNS Server= From ISP           Edit IP Alias= Yes
  IP Address= N/A
Third DNS Server= From ISP
  IP Address= N/A
DHCP Server Address= N/A



                Press ENTER to Confirm or ESC to Cancel:
```

Press [ENTER] to display Menu 3.2.1-IP Alias Setup, as shown next.

```
                        Menu 3.2.1 - IP Alias Setup

                IP Alias 1= No
                  IP Address= N/A
                  IP Subnet Mask= N/A
                  RIP Direction= N/A
                    Version= N/A
                  Incoming protocol filters= N/A
                  Outgoing protocol filters= N/A
                IP Alias 2= No
                  IP Address= N/A
                  IP Subnet Mask= N/A
                  RIP Direction= N/A
                    Version= N/A
                  Incoming protocol filters= N/A
                  Outgoing protocol filters= N/A

                 Enter here to CONFIRM or ESC to CANCEL:
```

Follow the instructions in the table on the next page to configure IP Alias parameters.

19.3.1 IP Alias Setup - Continued

FIELD	DESCRIPTION	EXAMPLE
IP Alias	Choose **Yes** to configure the LAN network for the WR1500 Wireless Router.	**Yes**
IP Address	Enter the IP address of your WR1500 Wireless Router in dotted decimal notation	192.168.1.1
IP Subnet Mask	Your WR1500 Wireless Router will automatically calculate the subnet mask based on the IP address that you assign. Unless you are implementing subnetting, use the subnet mask computed by the WR1500 Wireless Router	255.255.255.0
RIP Direction	Press [SPACE BAR] to select the RIP direction. Choices are **None, Both, In Only or Out Only.**	**None**
Version	Press [SPACE BAR] to select the RIP version. Choices are **RIP-1, RIP-2B or RIP-2M.**	**RIP-1**
Incoming Protocol Filters	Enter the filter set(s) you wish to apply to the incoming traffic between this node and the WR1500 Wireless Router.	
Outgoing Protocol Filters	Enter the filter set(s) you wish to apply to the outgoing traffic between this node and the WR1500 Wireless Router.	
When you have completed this menu, press [ENTER] at the prompt “Press ENTER to Confirm...” to save your configuration, or press [ESC] at any time to cancel.		

19.4 Wireless LAN Setup

Use menu 3.5 to set up your WR1500 Wireless Router as the Wireless Router. To edit menu 3.5, enter 3 from the main menu to display Menu 3 - LAN Setup. When menu 3 appears, press 5 and then press [ENTER] to display Menu 3.5 - Wireless LAN Setup as shown next.

The table on the following page describes the fields in this menu.

19.4 Wireless LAN Setup - Continued

FIELD	DESCRIPTION	EXAMPLE
ESSID	The ESSID (Extended Service Set IDentity) identifies the AP the wireless station is to associate to. Wireless stations associating to the AP must have the same ESSID. Enter a descriptive name up to 32 printable 7-bit ASCII characters.	**Wireless**
Hide ESSID	Press [SPACE BAR] and select **Yes** to hide the ESSID in the outgoing data frame so a intruder cannot obtain the ESSID through passive scanning.	**No**
Channel ID	Press [SPACE BAR] to select a channel. This allows you to set the operating frequency/channel depending on your particular region.	**CH01 2412MHz**
RTS Threshold	Setting this attribute to zero turns on the RTS/CTS handshake. Enter a value between 0 and 2432.	**2432**
Fragment Threshold	This is the maximum data fragment size that can be sent. Enter a value between 256 and 2432.	**2432**
WEP	Select **Disable** to allow wireless stations to communicate with the Wireless Routers without any data encryption. Select **64-bit WEP** or **128-bit WEP** to enable data encryption.	**Disable**
Default Key	Enter the key number (1 to 4) in this field. Only one key can be enabled at any one time. This key must be the same on the WR1500 Wireless Router and the wireless stations to communicate.	1
Key 1 to Key 4	The WEP keys are used to encrypt data. Both the WR1500 Wireless Router and the wireless stations must use the same WEP key for data transmission. If you chose **64-bit WEP** in the **WEP Encryption** field, then enter any 5 ASCII characters or 10 hexadecimal characters (“0-9”, “A-F”). If you chose **128-bit WEP** in the **WEP Encryption** field, then enter 13 ASCII characters or 26 hexadecimal characters (“0-9”, “A-F”). **Enter “Ox” before the key to denote a hexadecimal key. Don’t enter “Ox” before the key to denote a ASCII key.**	0x12345abcde
Authen. Method	Press [SPACE BAR] to select **Auto, Open System Only** or **Shared Key Only** and press [ENTER]. This field is **N/A** if WEP is not activated. If WEP encryption is activated, the default setting is **Auto.**	**Auto**
Block Intra-BSS Traffic	Press [SPACE BAR] to select **Yes** or **No** and press [ENTER].	**No**
Number of Associated Stations	Enter the maximum number of wireless stations that may connect to the WR1500 Wireless Router. The number should be from 1 to 8.	
Breathing LED	Press [SPACE BAR] to select **Yes** or **No** and press [ENTER].	**Yes**
Output Power	Press [SPACE BAR] to select **11 dBm, 13dBm, 15dBm** or **17dBm** and press [ENTER].	**17dBm**

When you have completed this menu, press [ENTER] at the prompt “Press ENTER to confirm or ESC to cancel” to save your configuration or press [ESC] to cancel and go back to the previous screen.

19.4.1 Configuring MAC Address Filter

Your WR1500 Wireless Router checks the MAC address of the wireless station device against a list of allowed or denied MAC addresses. However, intruders could fake allowed MAC addresses so MAC-based authentication is less secure than EAP authentication.

Follow the steps below to create the MAC address table on your WR1500 Wireless Router.

Step 1 - From the main menu, enter 3 to open Menu 3 - LAN Setup.

Step 2 - Enter 5 to display Menu 3.5 - Wireless LAN Setup.

```
                Menu 3.5 - Wireless LAN Setup

        ESSID= Wireless
        Hide ESSID= No
        Channel ID= CH01 2412MHz
        RTS Threshold= 0
        Frag. Threshold= 2432
        WEP Encryption= Disable
          Default Key= N/A
          Key1= N/A
          Key2= N/A
          Key3= N/A
          Key4= N/A
          Authen. Method= N/A
        Edit MAC Address Filter= No
        Edit Roaming Configuration= No
        Block Intra-BSS Traffic= No
        Number of Associated Stations= 32
        Breathing LED= Yes
        Output Power= 17dBm

        Press ENTER to Confirm or ESC to Cancel:
```

Step 3 - In the Edit MAC Address Filtering field, press [SPACE BAR] to select Yes and press [ENTER].

Menu 3.5.1 - WLAN MAC Address Filter displays as shown next.

```
                Menu 3.5.1 - WLAN MAC Address Filter

                Active= No
                Filter Action= Allowed Association
------------------------------------------------------------------------------
 1=  00:00:00:00:00:00   13=  00:00:00:00:00:00   25=  00:00:00:00:00:00
 2=  00:00:00:00:00:00   14=  00:00:00:00:00:00   26=  00:00:00:00:00:00
 3=  00:00:00:00:00:00   15=  00:00:00:00:00:00   27=  00:00:00:00:00:00
 4=  00:00:00:00:00:00   16=  00:00:00:00:00:00   28=  00:00:00:00:00:00
 5=  00:00:00:00:00:00   17=  00:00:00:00:00:00   29=  00:00:00:00:00:00
 6=  00:00:00:00:00:00   18=  00:00:00:00:00:00   30=  00:00:00:00:00:00
 7=  00:00:00:00:00:00   19=  00:00:00:00:00:00   31=  00:00:00:00:00:00
 8=  00:00:00:00:00:00   20=  00:00:00:00:00:00   32=  00:00:00:00:00:00
 9=  00:00:00:00:00:00   21=  00:00:00:00:00:00
10=  00:00:00:00:00:00   22=  00:00:00:00:00:00
11=  00:00:00:00:00:00   23=  00:00:00:00:00:00
12=  00:00:00:00:00:00   24=  00:00:00:00:00:00
------------------------------------------------------------------------------
                Enter here to CONFIRM or ESC to CANCEL:
```

The table on the next page describes the fields in this menu.

19.4.1 Configuring MAC Address Filter - Continued

FIELD	DESCRIPTION
Active	To enable MAC address filtering, press [SPACE BAR] to select **Yes** and press [ENTER].
Filter Action	Define the filter action for the list of MAC addresses in the MAC address filter table. To deny access to the WR1500 Wireless Router, press [SPACE BAR] to select **Deny Association** and press [ENTER]. MAC addresses not listed will be allowed to access the router. The default action, **Allowed Association,** permits association with the WR1500 Wireless Router. MAC addresses not listed will be denied access to the router.
MAC Address Filter	
1..32	Enter the MAC addresses (in XX:XX:XX:XX:XX:XX format) of the client computers that are allowed or denied access to the WR1500 Wireless Router in these address fields.
When you have completed this menu, press [ENTER] at the prompt “Press ENTER to confirm or ESC to cancel” to save your configuration or press [ESC] to cancel and go back to the previous screen.	

Chapter 20: Internet Access

This chapter describes how to configure the WR1500 Wireless Router for Internet Access.

20.1 Internet Access Configuration

Menu 4 allows you to enter the Internet Access information in one screen. Menu 4 is actually a simplified setup for one of the remote nodes that you can access in menu 11. Before you configure your WR1500 Wireless Router for Internet access, you need to collect your Internet account information from your ISP and telephone company.

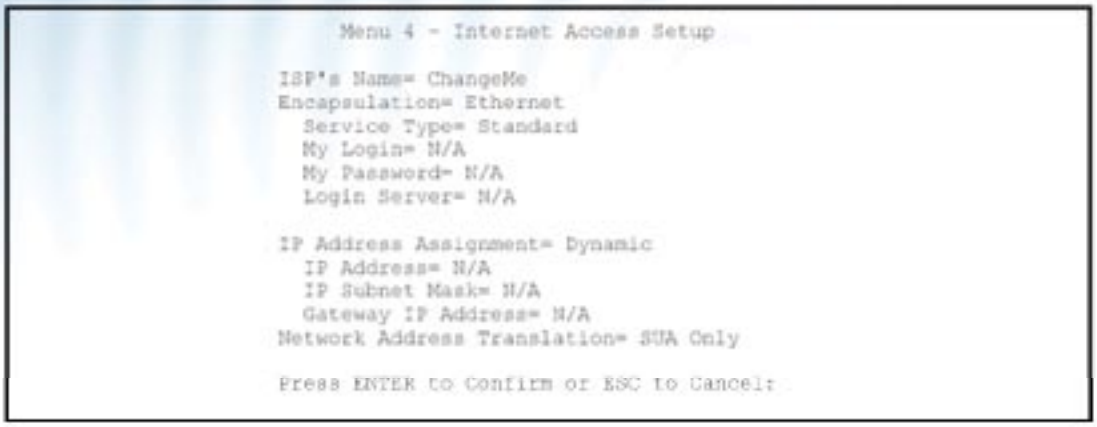
Use the following table to record your Internet Account Information.

Note that if you are using PPP or PPPoE encapsulation, then the only ISP information you need is a login name and password.

FIELD	DESCRIPTION	YOUR INFORMATION
System Name	Enter the name of the WR1500 Wireless Router (optional).	
Service Name (PPPoE)	Enter the PPPoE service name if the ISP supplies one. Enter “any if the ISP does not assign you one.	
Encapsulation	Select **Ethernet, PPPoE** or **PPTP**	
My Login	Enter the login name assigned by your ISP (for PPP/PPPoE only).	
My Password	Enter the password associated with your ISP assigned **My Login** (for PPP/PPPoE only).	
Idle Timeout (PPPoE or PPP)	Enter the time lapse, in seconds, before you automatically disconnect from the PPPoE or PPP server.	
IP Address	Enter if your IP address is not dynamically assigned.	
Network Address Translation	Select **Full Feature, SUA Only** or **None.**	
DNS Server Address Assignment	**Primary DNS server Secondary DNS server** Enter when using RFC 1483 Encapsulation or a static IP address.	

20.2 Internet Access Setup

From the main menu, type 4 to display Menu 4 - Internet Access Setup, as shown next.



The following table contains instructions on how to configure your WR1500 Wireless Router for Internet access.

Internet Access Setup

FIELD	DESCRIPTION	EXAMPLE
ISP's Name	Enter the name of your Internet Service Provider. This information is for identification purposes only.	ChangeMe
Encapsulation	Press **[SPACE** BAR] to select the method of encapsulation used by your ISP. Choices are **PPPoE, PPP** or **Ethernet.**	**Ethernet**
Service Type	This field is available if you select the **Ethernet** encapsulation. Press [SPACE BAR] to select the service type then press [ENTER]. Choose a RoadRunner flavor if your ISP is using Time Warner's RoadRunner; otherwise choose **Standard.** The **User Name, Password** and **Login Server** fields are not applicable (N/A) for the latter. Choose from **Standard, Telstra** (RoadRunner Telstra or BigPond authentication method), **RR-Manager** (RoadRunner Manager authentication method) or **RR-Toshiba** (RoadRunner Toshiba authentication method).	**Standard**
My Login	Configure the **My Login** and **My Password** fields for PPP and PPPoE encapsulation only. Enter the login name exactly as your ISP gives you.	N/A
My Password	Enter the password associated with the login name above.	N/A
Login Server	Enter the IP address of the login server in dotted decimal notation.	10.11.12.13
IP Address Assignment	Press [SPACE BAR] and then [ENTER] to select **Static** or **Dynamic** address assignment.	Static
IP Address	Enter the IP address supplied by your ISP if applicable.	10.11.12.20

Table continued on next page

20.2 Internet Access Setup - Continued

IP Subnet Mask	Your WR1500 Wireless Router will automatically calculate the subnet mask based on the IP address that you entered. Unless you are implementing subnetting, use the subnet mask computed by the WR1500 Wireless Router.	
Gateway IP Address	Type the IP address of the gateway. The gateway is an immediate neighbor of your WR1500 Wireless Router that will forward the packet to the destination. On the LAN, the gateway must be a router on the same segment as your WR1500 Wireless Router.	
Network Address Translation	Press [SPACE BAR] and then [ENTER] to select **None, SUA Only** or **Full Feature.** Please see the *NAT Chapter for* more details.	**SUA Only**
When you have completed this menu, press [ENTER] at the prompt “Press ENTER to Confirm...” to save your configuration, or press [ESC] at any time to cancel.		

If all your settings are correct your WR1500 Wireless Router should connect automatically to the Internet. If the connection fails, note the error message that you receive on the screen and take the appropriate troubleshooting steps.

Part IX

Appendices

This part contains appendices that are designed to assist you with setup and troubleshooting of the WR1500.

Appendix A

Troubleshooting

This appendix covers potential problems and possible remedies. After each problem description, some instructions are provided to help you to diagnose and to solve the problem.

Problems Starting Up the WR1500 Wireless Router

Troubleshooting the Start-Up of Your WR1500 Wireless Router

PROBLEM	CORRECTIVE ACTION	
None of the LEDs turn on when I plug in the power adaptor.	Make sure you are using the supplied power adaptor and that it is plugged in to an appropriate power source. Check that the power source is turned on. If the problem persists, you may have a hardware problem. In this case, you should contact your local vendor.	
I cannot access the WR1500 Wireless Router via the console port.	1. Check to see if the WR1500 Wireless Router is connected to your computer's console port.	
	2. Check to see if the communications program is configured correctly. The communications software should be configured as follows:	VT100 terminal emulation.
		9600 bps is the default speed on leaving the factory. Try other speeds in case the speed has been changed.
		No parity, 8 data bits, 1 stop bit, data flow set to none.

Problems with the Password - Troubleshooting the Password

PROBLEM	CORRECTIVE ACTION
I cannot access the WR1500 Wireless Router.	The **Password** and **Username** fields are case-sensitive. Make sure that you enter the correct password and username using the proper casing. Use the **RESET** button on the side panel of the WR1500 Wireless Router to restore the factory default configuration file (hold this button in for more than five seconds). This will restore all of the factory defaults including the password.

Problems with the Ethernet Interface - Troubleshooting the Ethernet Interface

PROBLEM	CORRECTIVE ACTION
I cannot access the WR1500 Wireless Router from the Ethernet	If all of the **LAN** LEDs on the front panel are off, check the Ethernet cable connection between your WR1500 Wireless Router and the computer connected to the **LAN** port. Check for faulty Ethernet cables. Make sure the computer's Ethernet adapter is installed and working properly. Verify that the IP addresses and the subnet masks of the WR1500 Wireless Router and the computer are on the same subnet.
I cannot ping any computer on the LAN.	If all of the **LAN** LEDs on the front panel are off, check the Ethernet cable connection between your WR1500 Wireless Router and the computer connected to the **LAN** port. Verify that the IP addresses and the subnet masks of the WR1500 Wireless Router and the computers are on the same subnet.

Problems with the WAN Interface - Troubleshooting the WAN Interface

PROBLEM	CORRECTIVE ACTION
I cannot get a WAN IP address from the ISP.	The ISP provides the WAN IP address after authenticating you. Authentication may be through the user name and password, the MAC address or the host name. The username and password apply to PPPoE and PPTP encapsulation only. Make sure that you have entered the correct **Service Type, User Name** and **Password** (be sure to use the correct casing). Refer to the *WAN Screens* chapter (Web Configuration Utility) or the *Internet Access* chapter (SMT). Clone the MAC address from your computer on the LAN as the WR1500 Wireless Router's WAN MAC address. Refer to the *WAN Screens* chapter (Web Configuration Utility) or the *General and WAN Setup* chapter (SMT). It is recommended that you clone your computer's MAC address, even if your ISP presently does not require MAC address authentication. Configure your computer's name as the WR1500 Wireless Router's system name. Refer to the *Wizard Setup* chapter (Web Configuration Utility) or the *General and WAN Setup* chapter (SMT).

Problems with Internet Access - Troubleshooting Internet Access

PROBLEM	CORRECTIVE ACTION
I cannot access the Internet.	Connect your cable/DSL modem to the WR1500 Wireless Router using the appropriate cable. Check with the manufacturer of your cable/DSL device about your cable requirement because for some devices may require a crossover cable and others a straight-through Ethernet cable. Verify your WAN settings. Refer to the *WAN* chapter (Web Configuration Utility) or the *Internet Access* chapter (SMT). Make sure you entered the correct user name and password. For wireless stations, check that both the WR1500 Wireless Router and wireless station(s) are using the same ESSID, channel and WEP keys (if WEP encryption is activated).
Internet connection disconnects	If you use PPTP or PPPoE encapsulation, check the idle time-out setting. Refer to the *WAN* chapter (Web Configuration Utility) or the *Remote Node Configuration* chapter (SMT). Contact your ISP.

Problems with Telnet - Troubleshooting Telnet

PROBLEM	CORRECTIVE ACTION
I cannot access the WR1500 Wireless Router through Telnet.	Refer to the Problems with the Ethernet Interface section for instructions on checking your Ethernet connection.

Problems with the WLAN Interface - Troubleshooting the WLAN Interface

PROBLEM	CORRECTIVE ACTION
I cannot ping any computer on the WLAN.	Make sure the wireless card is properly inserted in the WR1500 Wireless Router and the WLAN LED is on. Make sure the wireless adapter on the wireless station is working properly. Check that both the WR1500 Wireless Router and wireless station(s) are using the same ESSID, channel and WEP keys (if WEP encryption is activated).

Appendix B

Setting Up Your Computer's IP Address

All computers must have a 10M or 100M Ethernet adapter card and TCP/IP installed.

Windows 95/98/Me/NT/2000/XP, Macintosh OS 7 and later operating systems and all versions of UNIX/LINUX include the software components you need to install and use TCP/IP on your computer. Windows 3.1 requires the purchase of a third-party TCP/IP application package.

TCP/IP should already be installed on computers using Windows NT/2000/XP, Macintosh OS 7 and later operating systems.

After the appropriate TCP/IP components are installed, configure the TCP/IP settings in order to "communicate" with your network.

If you manually assign IP information instead of using dynamic assignment, make sure that your computers have IP addresses that place them in the same subnet as the WR1500 Wireless Router's LAN port.

Note - Although the WR1500 can communicate with computers running all of the above OS', be advised that other products in the 1500 family (1500WLAN and 1500USB) are compatible with computers running only Windows 2000 or XP.

Windows 95/98/Me

Click **Start, Settings, Control Panel** and double-click the **Network** icon to open the Network window.

The Network window Configuration tab displays a list of installed components. You need a network adapter, the TCP/IP protocol and Client for Microsoft Networks.

If you need the adapter:
a. In the Network window, click Add.
b. Select Adapter and then click Add.
c. Select the manufacturer and model of your network adapter and then click OK.

If you need TCP/IP:
a. In the Network window, click Add.
b. Select Protocol and then click Add.
c. Select Microsoft from the list of manufacturers.
d. Select TCP/IP from the list of network protocols and then click OK.

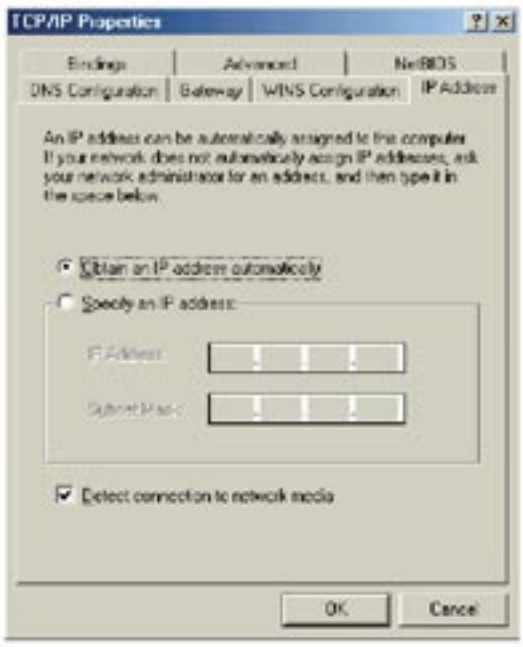
If you need Client for Microsoft Networks:
a. Click Add.
b. Select Client and then click Add.
c. Select Microsoft from the list of manufacturers.
d. Select Client for Microsoft Networks from the list of network clients and then click OK.
e. Restart your computer so the changes you made take effect. In the Network window Configuration tab, select your network adapter's TCP/IP entry and click Properties.

Windows 95/98/Me - Continued

1. Click the IP Address tab.

-If your IP address is dynamic, select Obtain an IP address automatically.

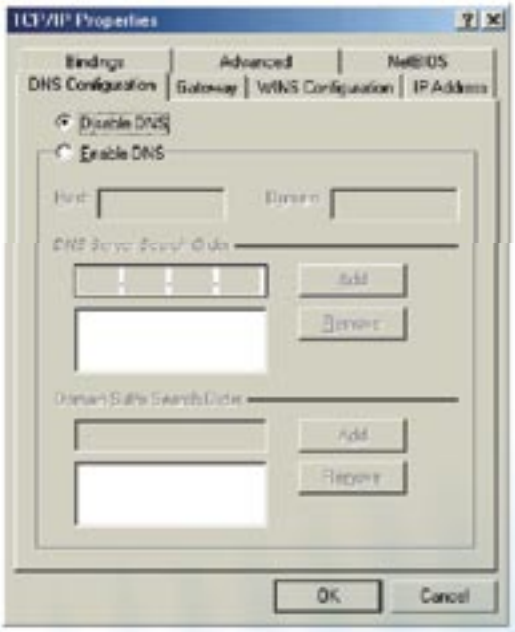
-If you have a static IP address, select Specify an IP address and type your information into the IP Address and Subnet Mask fields.


TCP/IP Properties
Bindings
Advanced
NetBIOS
DNS Configuration
Gateway
WINS Configuration
IP Address
An IP address can be automatically assigned to this computer. If your network does not automatically assign IP addresses, ask your network administrator for an address, and then type it in the space below.
Obtain an IP address automatically
Specify an IP address:
IP Address:
Subnet Mask:
Detect connection to network media
OK
Cancel

2. Click the DNS Configuration tab.

-If you do not know your DNS information, select Disable DNS.

-If you know your DNS information, select Enable DNS and type the information in the fields below (you may not need to fill them all in).



Windows 95/98/Me - Continued

3. Click the Gateway tab.

-If you do not know your gateway's IP address, remove previously installed gateways.

-If you have a gateway IP address, type it in the New gateway field and click Add.

4. Click OK to save and close the TCP/IP Properties window.

5. Click OK to close the Network window. Insert the Windows CD if prompted.

6. Turn on your WR1500 Wireless Router and re start your computer when prompted.

Verifying Your Computer's IP Address

1. Click Start and then Run.

2. In the Run window, type "winipcfg" and then click OK to open the IP Configuration window.

3. Select your network adapter. You should see your computer's IP address, subnet mask and default gateway.

Windows 2000/XP

1. **For Windows XP, click start, Control Panel. In Windows 2000/NT, click Start, Settings, Control Panel.**

2. **For Windows XP, click Network Connections. For Windows 2000/NT, click Network and Dial-up Connections.**

3. **Right-click Local Area Connection and then click Properties.**

Windows 2000/XP - Continued

4. **Select Internet Protocol (TCP/IP) (under the General tab in Win XP) and click Properties.**

Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports this capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

5. **The Internet Protocol TCP/IP Properties window opens (the General tab in Windows XP).**

-If you have a dynamic IP address click Obtain an IP address automatically.

-If you have a static IP address click Use the following IP Address and fill in the IP address, Subnet mask, and Default gateway fields.

Click Advanced.

Windows 2000/XP - Continued

6. **If you do not know your gateway's IP address, remove any previously installed gateways in the IP Settings tab and click OK.**

Do one or more of the following if you want to configure additional IP addresses:

-In the IP Settings tab, in IP addresses, click Add.

-In TCP/IP Address, type an IP address in IP address and a subnet mask in Subnet mask, and then click Add.

-Repeat the above two steps for each IP address you want to add.

-Configure additional default gateways in the IP Settings tab by clicking Add in Default gateways.

-In TCP/IP Gateway Address, type the IP address of the default gateway in Gateway. To manually configure a default metric (the number of transmission hops), clear the Automatic metric check box and type a metric in Metric.

-Click Add.

-Repeat the previous three steps for each default gateway you want to add.

-Click OK when finished.

Windows 2000/XP - Continued

Internet Protocol (TCP/IP) Properties
General
Alternate Configuration
You can get IP settings assigned automatically if your network supports the capability. Otherwise, you need to ask your network administrator for the appropriate IP settings.
Obtain an IP address automatically
Use the following IP address:
IP address:
Subnet mask:
Default gateway:
Obtain DNS server address automatically
Use the following DNS server addresses:
Preferred DNS server:
Alternate DNS server:
Advanced...
OK
Cancel

7. **In the Internet Protocol TCP/IP Properties window (the General tab in Windows XP):**

-Click Obtain DNS server address automatically if you do not know your DNS server IP address(es).

-If you know your DNS server IP address(es), click Use the following DNS server addresses, and type them in the Preferred DNS server and Alternate DNS server fields.

If you have previously configured DNS servers, click Advanced and then the DNS tab to order them.

8. **Click OK to close the Internet Protocol (TCP/IP) Properties window.**

9. **Click OK to close the Local Area Connection Properties window.**

10. **Turn on your WR1500 Wireless Router and restart your computer (if prompted).**

Verifying Your Computer's IP Address

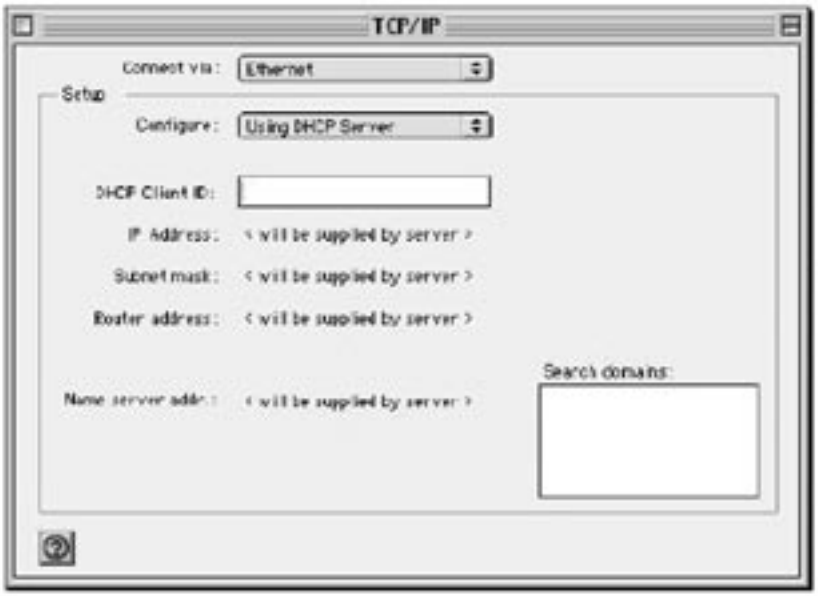
1. **Click Start, All Programs, Accessories and then Command Prompt.**

2. **In the Command Prompt window, type "ipconfig" and then press [ENTER]. You can also open Network Connections, right-click a network connection, click Status and then click the Support tab.**

Apple Macintosh OS 8 / 9

1. Click the Apple menu, Control Panel and double-click TCP/IP to open the TCP/IP Control Panel.

2. Select Ethernet built-in from the Connect via list.



3. For dynamically assigned settings, select Using DHCP Server from the Configure: list.

D2D TECHNOLOGY

Apple Macintosh OS 8 / 9 - Continued

4. For statically assigned settings, do the following:

-From the Configure box, select Manually.

-Type your IP address in the IP Address box.

-Type your subnet mask in the Subnet mask box.

-Type the IP address of your WR1500 Wireless Router in the Router address box.

5. Close the TCP/IP Control Panel.

6. Click Save if prompted, to save changes to your configuration.

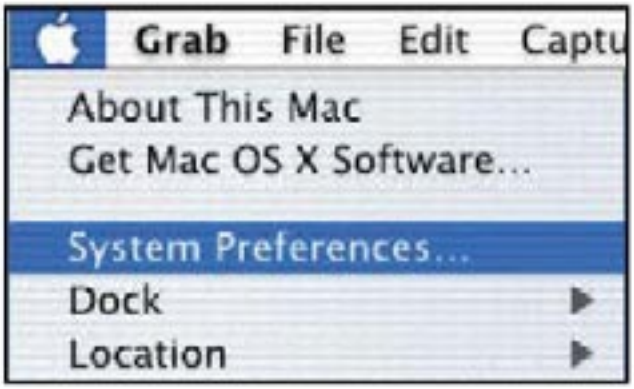
7. Turn on your WR1500 Wireless Router and restart your computer (if prompted).

Verifying Your Computer's IP Address

Check your TCP/IP properties in the TCP/IP Control Panel window.

Macintosh OS X

1. Click the Apple menu, and click System Preferences to open the System Preferences window.



Macintosh OS X - Continued

2. Click Network in the icon bar.

- Select Automatic from the Location list.
- Select Built-in Ethernet from the Show list.
- Click the TCP/IP tab.

3. For dynamically assigned settings, select Using DHCP from the Configure list.

4. For statically assigned settings, do the following:

- From the Configure box, select Manually.
- Type your IP address in the IP Address box.
- Type your subnet mask in the Subnet mask box.
- Type the IP address of your WR1500 Wireless Router in the Router address box.

5. Click Apply Now and close the window.

6. Turn on your WR1500 Wireless Router and restart your computer (if prompted).

Verifying Your Computer's IP Address

Check your TCP/IP properties in the Network window.

Appendix C

PPoE

PPPoE in Action

An ADSL modem bridges a PPP session over Ethernet (PPP over Ethernet, RFC 2516) from your PC to an ATM PVC (Permanent Virtual Circuit), which connects to a DSL Access Concentrator where the PPP session terminates (see the next figure). One PVC can support any number of PPP sessions from your LAN. PPPoE provides access control and billing functionality in a manner similar to dial-up services using PPP.

Benefits of PPPoE

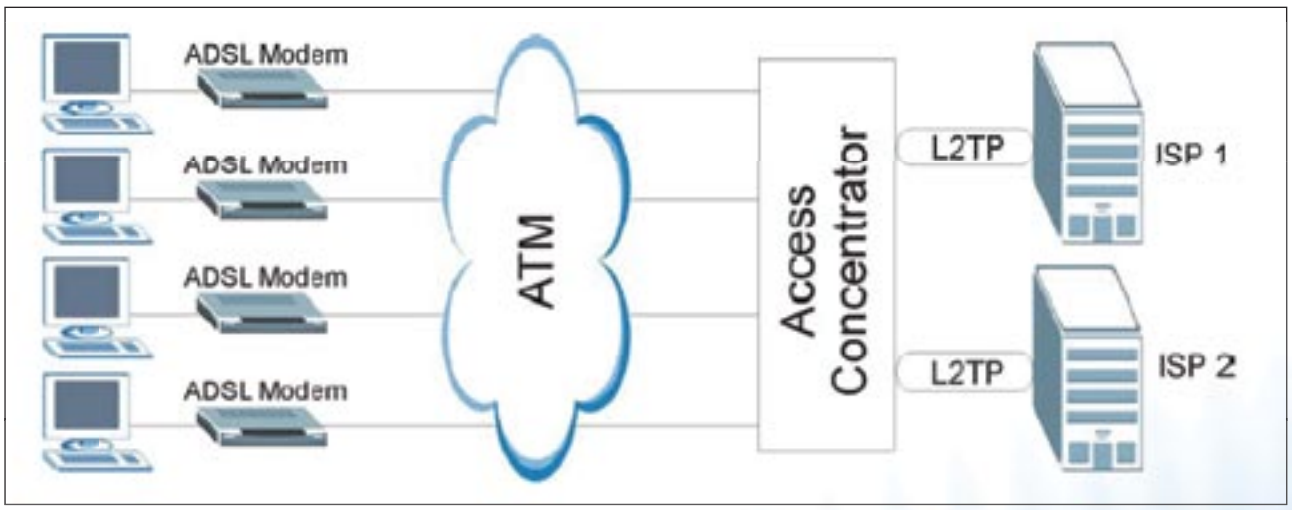
PPPoE offers the following benefits:

1. It provides you with a familiar dial-up networking (DUN) user interface.
2. It lessens the burden on the carriers of provisioning virtual circuits all the way to the ISP on multiple switches for thousands of users. For GSTN (PSTN & ISDN), the switching fabric is already in place.

3. It allows the ISP to use the existing dial-up model to authenticate and (optionally) to provide differentiated services.

Traditional Dial-up Scenario

The following diagram depicts a typical hardware configuration where the PCs use traditional dial-up networking.



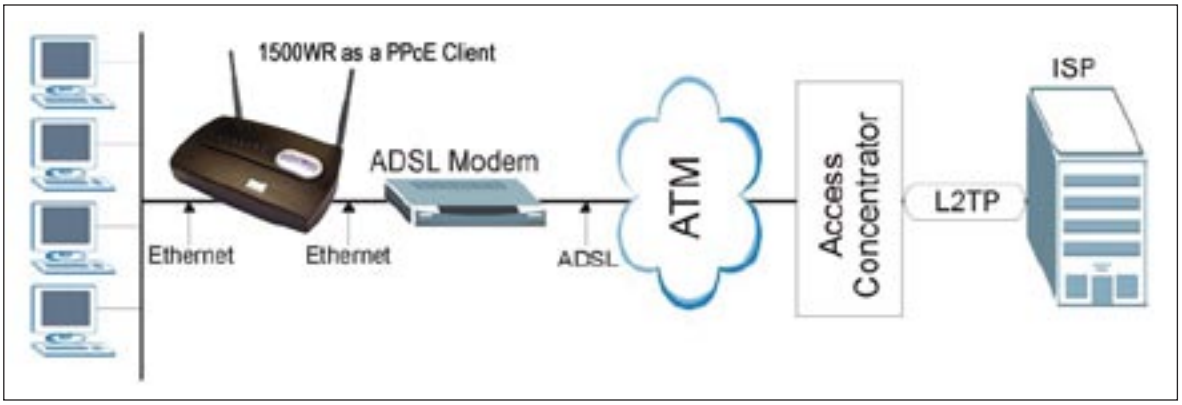
How PPPoE Works

The PPPoE driver makes the Ethernet appear as a serial link to the PC and the PC runs PPP over it, while the modem bridges the Ethernet frames to the Access Concentrator (AC). Between the AC and an ISP, the AC is acting as a L2TP (Layer 2 Tunneling Protocol) LAC (L2TP Access Concentrator) and tunnels the PPP frames to the ISP. The L2TP tunnel is capable of carrying multiple PPP sessions.

With PPPoE, the VC (Virtual Circuit) is equivalent to the dial-up connection and is between the modem and the AC, as opposed to all the way to the ISP. However, the PPP negotiation is between the PC and the ISP.

WR1500 Wireless Router as a PPPoE Client

When using the WR1500 Wireless Router as a PPPoE client, the PCs on the LAN see only Ethernet and are not aware of PPPoE. This alleviates the administrator from having to manage the PPPoE clients on the individual PCs.



Appendix D

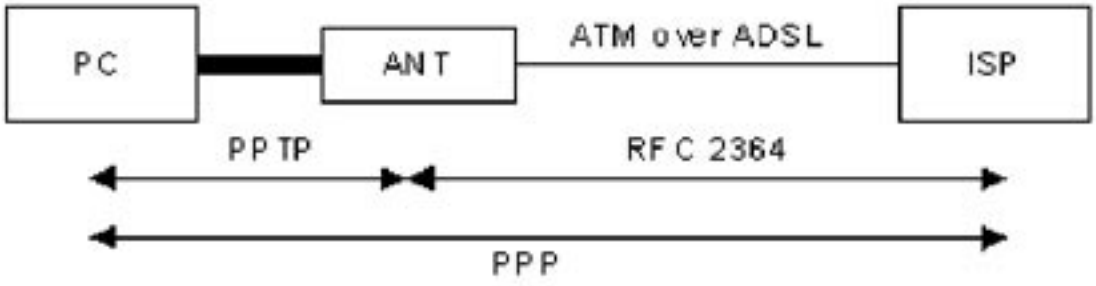
PPTP

What is PPTP?

PPTP (Point-to-Point Tunneling Protocol) is a Microsoft proprietary protocol (RFC 2637 for PPTP is informational only) to tunnel PPP frames.

How can we transport PPP frames from a PC to a broadband modem over Ethernet?

A solution is to build PPTP into the ANT (ADSL Network Termination) where PPTP is used only over the short haul between the PC and the modem over Ethernet. For the rest of the connection, the PPP frames are transported with PPP over AAL5 (RFC 2364). The PPP connection, however, is still between the PC and the ISP. The various connections in this setup are depicted in the following diagram. The drawback of this solution is that it requires one separate ATM VC per destination.



PPTP and the WR1500 Wireless Router

When the WR1500 Wireless Router is deployed in such a setup, it appears as a PC to the ANT. In Windows VPN or PPTP Pass-Through feature, the PPTP tunneling is created from Windows 95,98 and NT clients to an NT server in a remote location.

The pass-through feature allows users on the network to access a different remote server using the WR1500 Wireless Router's Internet connection. In NAT mode, the WR1500 Wireless Router is able to pass the PPTP packets to the internal PPTP server (i.e. NT server) behind the NAT. Users need to forward PPTP packets to port 1723 by configuring the server in Menu 15.2 - Server Set Setup.

In the case above as the remote PPTP Client initializes the PPTP connection, the user must configure the PPTP clients. The WR1500 Wireless Router initializes the PPTP connection hence; there is no need to configure the remote PPTP clients.

PPTP Protocol Overview

PPTP is very similar to L2TP, since L2TP is based on both PPTP and L2F (Cisco's Layer 2 Forwarding). Conceptually, there are three parties in PPTP, namely the PNS (PPTP Network Server), the PAC (PPTP Access Concentrator) and the PPTP user. The PNS is the box that hosts both the PPP and the PPTP stacks and forms one end of the PPTP tunnel.

The PAC is the box that dials/answers the phone calls and relays the PPP frames to the PNS. The PPTP user is not necessarily a PPP client (can be a PPP server too). Both the PNS and the PAC must have IP connectivity; however, the PAC must in addition have dial-up capability. The phone call is between the user and the PAC and the PAC tunnels the PPP frames to the PNS. The PPTP user is unaware of the tunnel between the PAC and the PNS.

PPTP Protocol Overview

Microsoft includes PPTP as a part of the Windows OS. In Microsoft's implementation, the PC, and hence the WR1500 Wireless Router, is the PNS that requests the PAC (the ANT) to place an outgoing call over AAL5 to an RFC 2364 server.

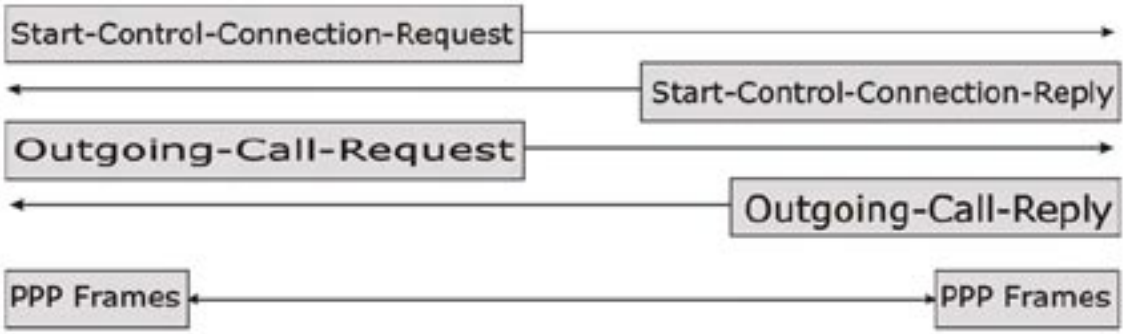
Control & PPP connections

Each PPTP session has distinct control connection and PPP data connection.

Call Connection

The control connection runs over TCP. Similar to L2TP, a tunnel control connection is first established before call control messages can be exchanged. Please note that a tunnel control connection supports multiple call sessions.

The following diagram depicts the message exchange of a successful call setup between a PC and an ANT.



Example Message Exchange between PC and an ANT

The PPP frames are tunneled between the PNS and PAC over GRE (General Routing Encapsulation, RFC 1701,1702). The individual calls within a tunnel are distinguished using the Call ID field in the GRE header.

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